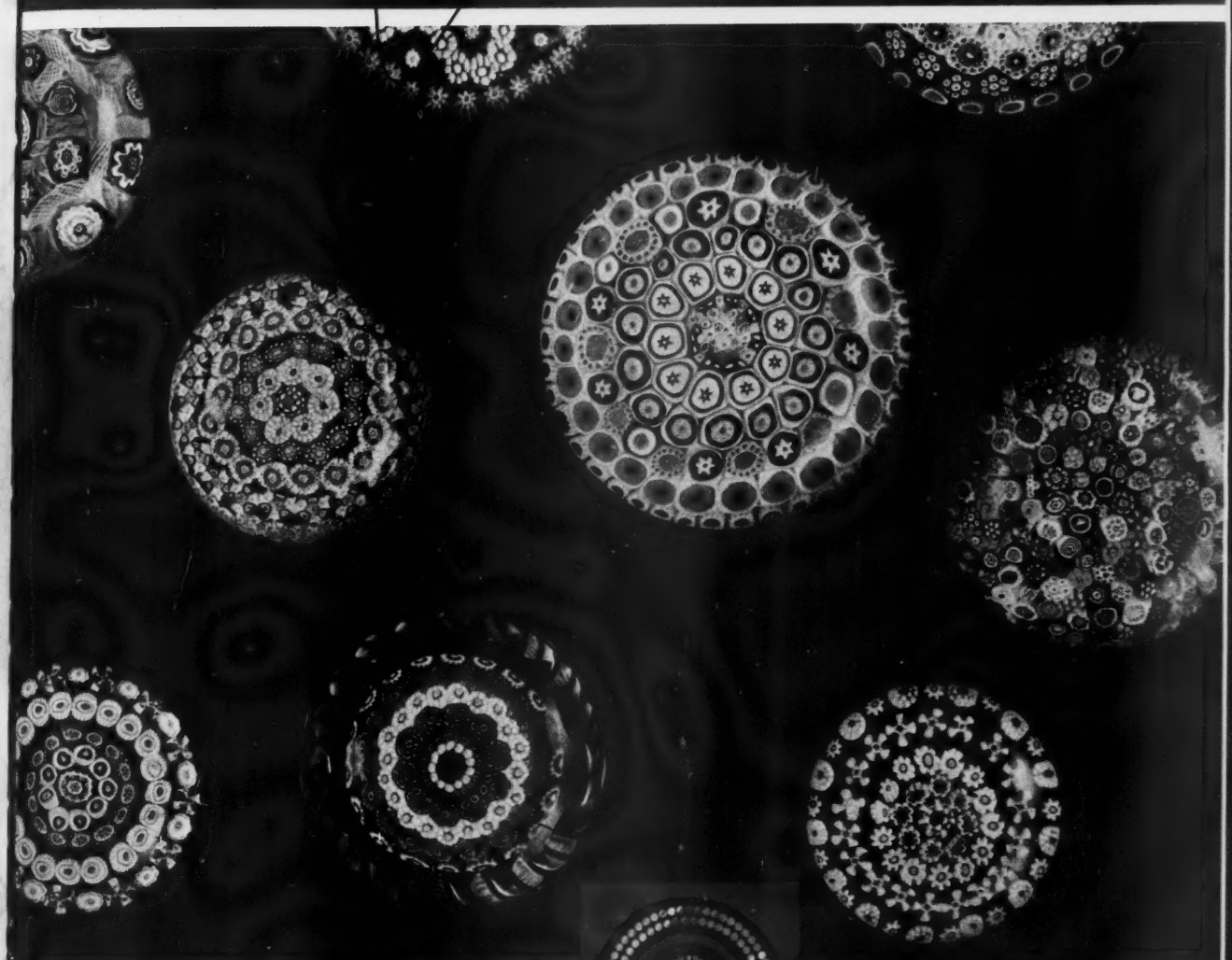
ELECTRICAL REVIEW

12 JULY 1957 PRICE 1s 6d



These are not sections of Telcon cable! They are, in fact, specimens of valuable French Glass paperweights from the collection of Lories Ltd of London. They were made about 1845, the year in which the Telcon group of companies was founded. While these masterpieces are invested with a beauty all their own, they also display the skill in design and craftsmanship in manufacture which is typical of all Telcon products. Telcon manufactured the first polythene insulated cable to be made in the world, and it is natural that having pioneered this type of cable Telcon remain in the van of cable design and manufacturing technique.

TELCON

THE TELEGRAPH CONSTRUCTION AND MAINTENANCE CO. LIMITED

Enquiries to: Sales Division, Mercury House, Theobald's Rd., London, W.C.1. HOLborn 8711

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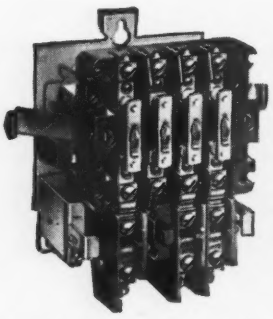
You can standardise on motor starters with MEM 'Autoline'

WHEN a new motor comes in you're never stuck for a starter if you keep a few MEM "AUTOLINES" in stock. The big advantage of the "AUTOLINE" is that it will provide overload precision protection for all motors rated between ¼ h.p. and 15 h.p.

The heaters are the only variable component involved and these can be selected from a range of 40 heaters to ensure precision protection for any motor up to 15 h.p. (25 amps. max.).

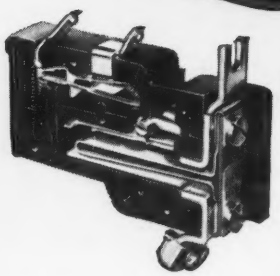
The MEM "AUTOLINE" is built to an advanced design produced by one of Britain's leading specialists in motor control gear. It has extra safety clearances and is substantially made in every detail.

Please send for Autoline Booklet No. 356(X).

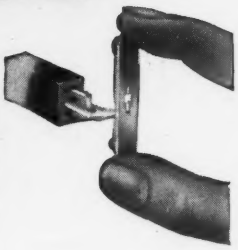


The Skeleton Pattern Units can be combined in various ways to meet a wide variety of different needs on machine tool applications.

Any MEM "AUTOLINE" starter can be changed from Automatic to Manual resetting operation in a few moments. A cover with "Reset" button only is available.



Exclusive new overload relay design with heaters specially designed for each rating means accurate protection under all conditions.

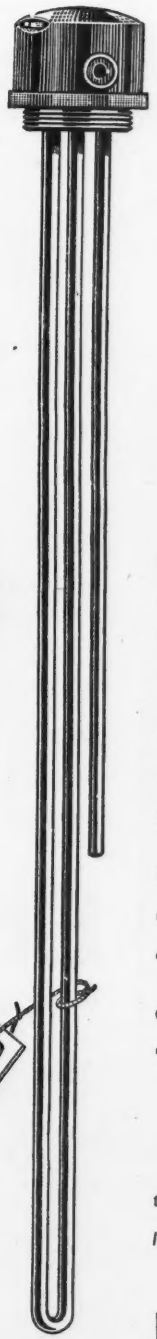


Contacts are of solid silver. Contact replacement is especially simple. Just flick over a spring catch and lift off.

MEM

MIDLAND ELECTRIC MANUFACTURING CO. LTD., TYSELEY, BIRMINGHAM, 11

we don't want to be Big Headed about it -



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IMMERSION HEATERS

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There are four lengths for vertical fixing through the top dome of a hot water cylinder and two lengths for inserting through the side of a tank or cylinder.

But, the **'SLIMROD'S'** crowning glory is its head — and the reduction in size of the terminal cover which has a projection of only 2½".

Our **Leaflet No. 81** gives a lot of helpful information about the **'SLIMROD'** — Ask us to send you copies.

HEAD NOTE: *We are asked how it is that we remain so modest about such a remarkable achievement. Perhaps it is that we are accustomed to repeated high praise and refrain from letting it go to our head — except as a spur to even better things . . . !*

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Accidents will happen so why not be prepared!

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It is a simple matter to disconnect leads, remove fixing bolts, slide out of position and insert a spare bank.

E.M.B. draw out type of resistances are rapidly finding favour in steel works and similar applications where 'down time' must be avoided at all costs.

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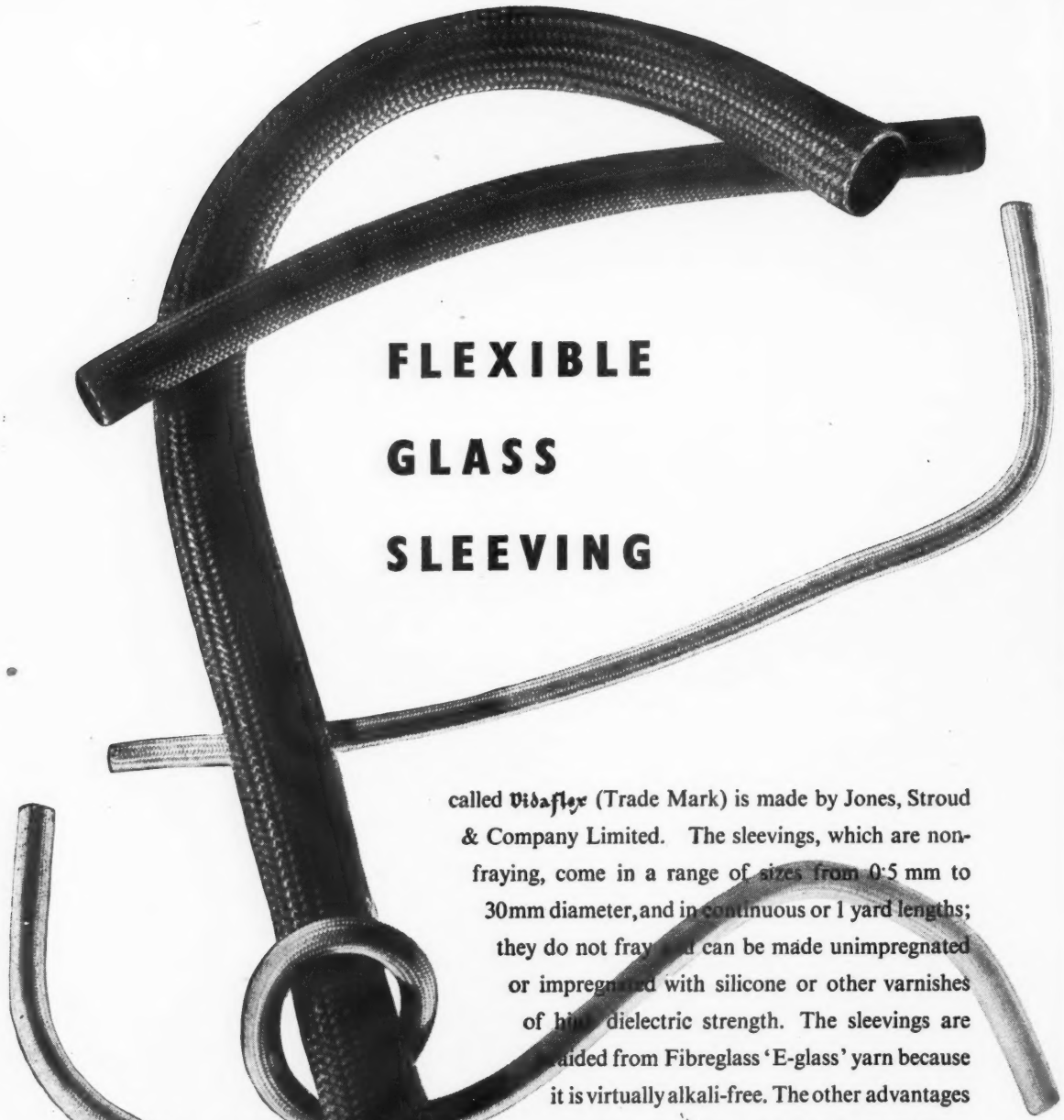

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called Vidaflex (Trade Mark) is made by Jones, Stroud & Company Limited. The sleevings, which are non-fraying, come in a range of sizes from 0·5 mm to 30mm diameter, and in continuous or 1 yard lengths; they do not fray and can be made unimpregnated or impregnated with silicone or other varnishes of high dielectric strength. The sleevings are braided from Fibreglass 'E-glass' yarn because it is virtually alkali-free. The other advantages of these sleevings—they are heat-resisting, rot-proof and unaffected by climatic conditions—are due to the fact that they are . . .

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Other points you will observe in this range will be:

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The smooth working of the simple, yet robust shutter mechanism.

The snap acting switch with its solid silver contacts.

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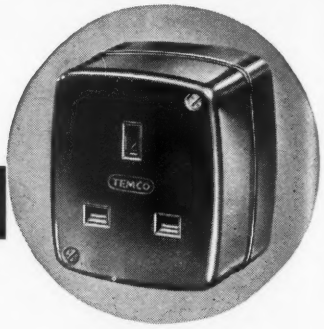

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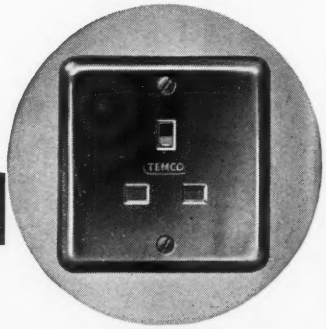

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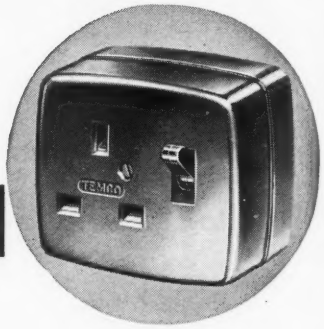

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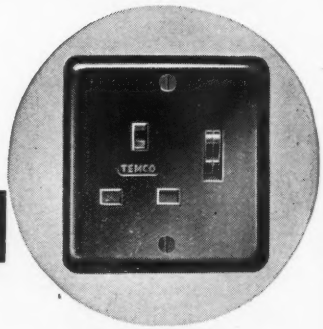

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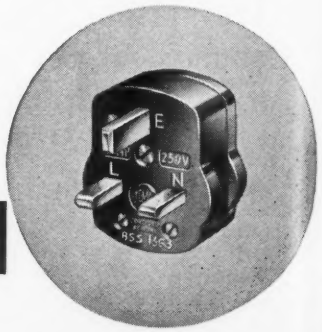

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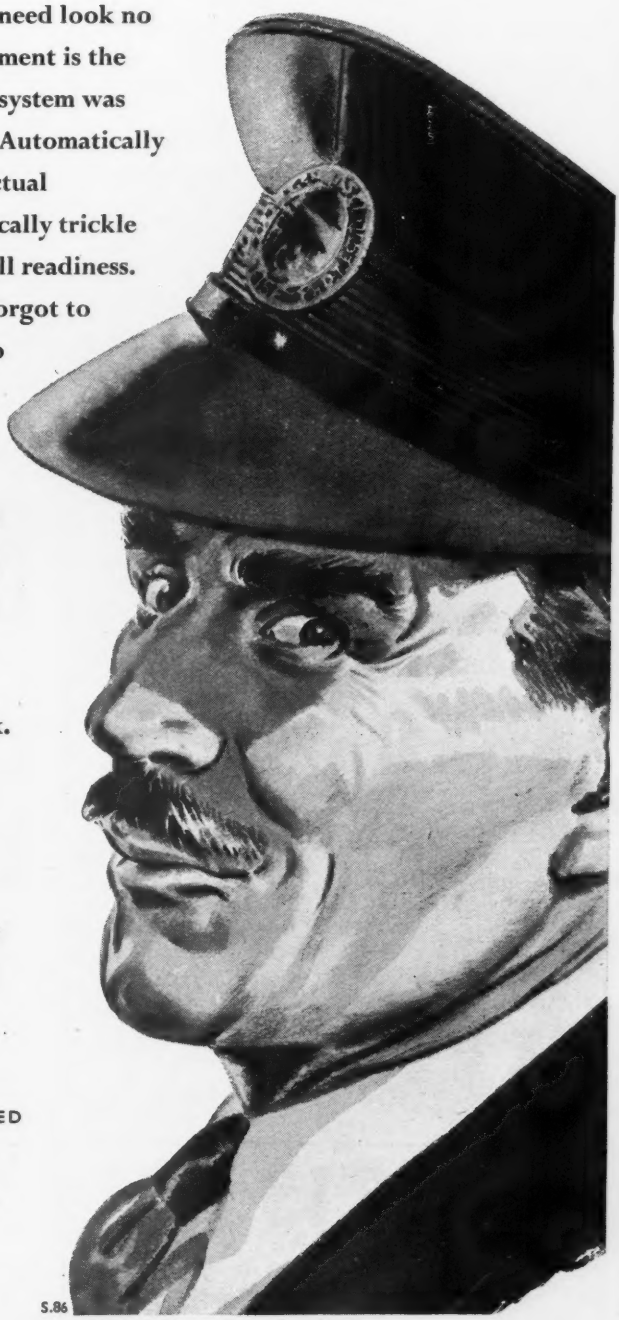

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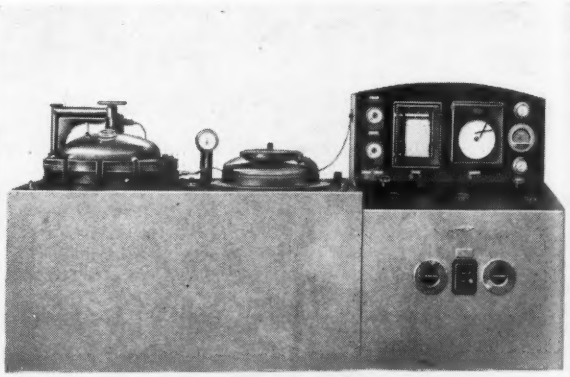

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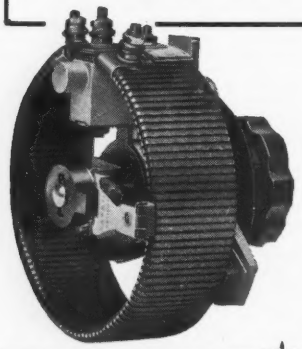

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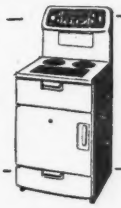

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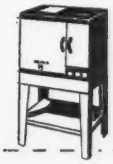

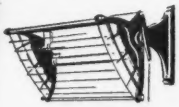

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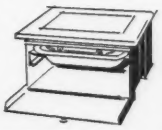

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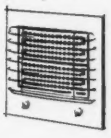

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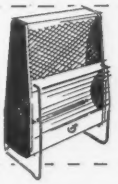

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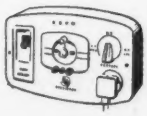

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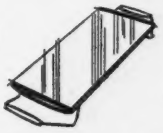

* *All Prices include P.T. where applicable.*

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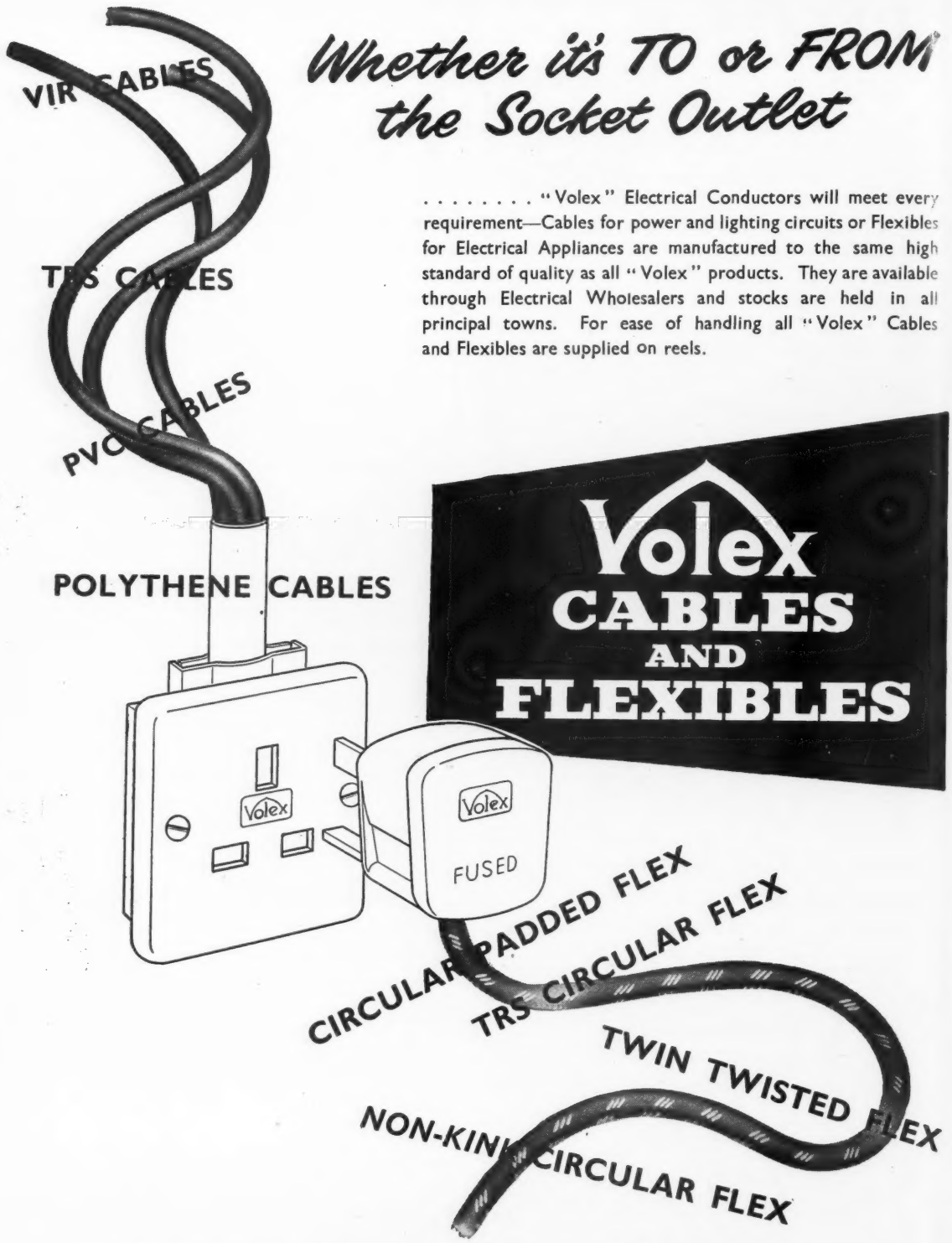

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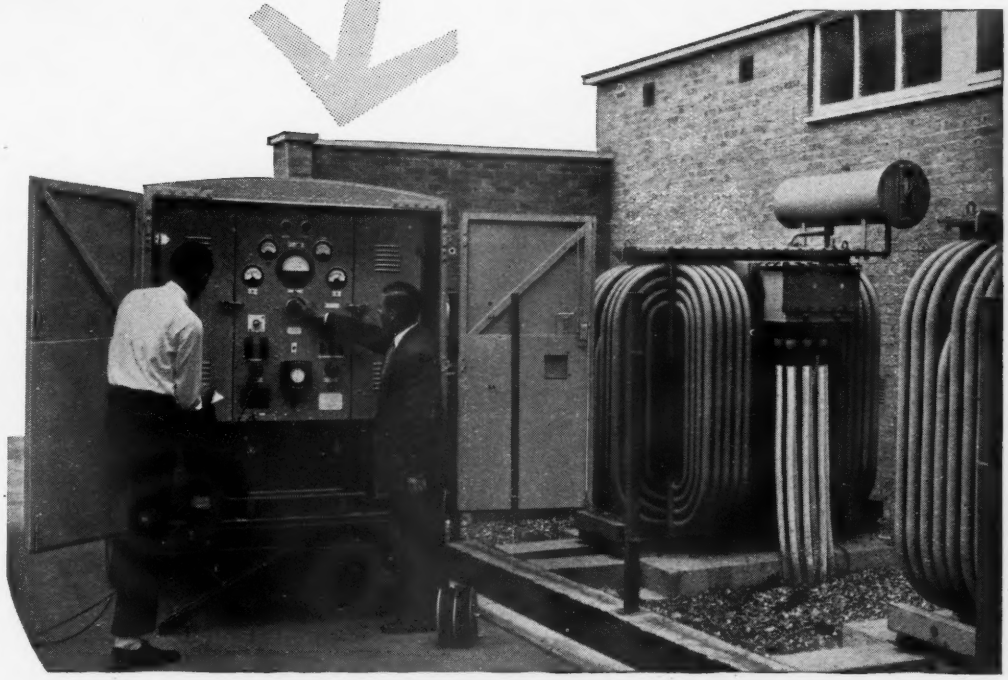

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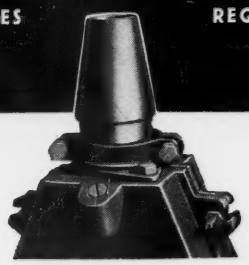

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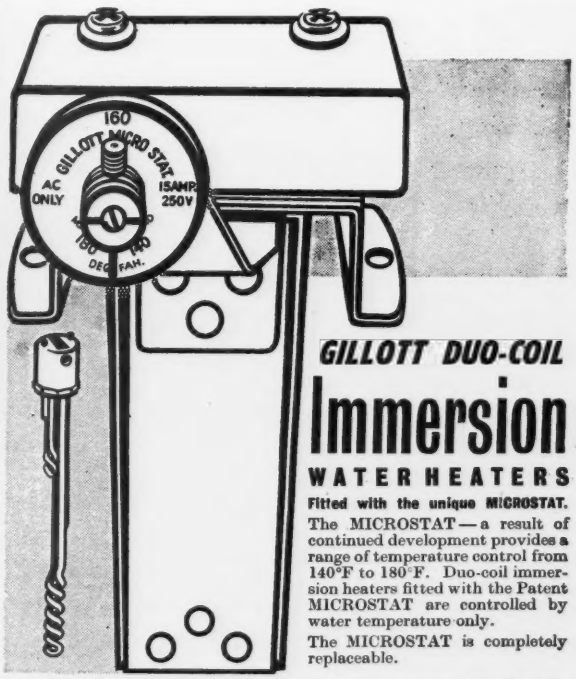

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The MICROSTAT—a result of continued development provides a range of temperature control from 140°F to 180°F. Duo-coil immersion heaters fitted with the Patent MICROSTAT are controlled by water temperature only.

The MICROSTAT is completely replaceable.

Specify DUO-COIL immersion heaters fitted with the MICROSTAT

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GILLOTT ELECTRO APPLIANCES LIMITED

Cotswold Works, Chalford, near Stroud, Glos

One of the group of companies associated with The Southern Area Electric Corporation Limited

JSP GIM17

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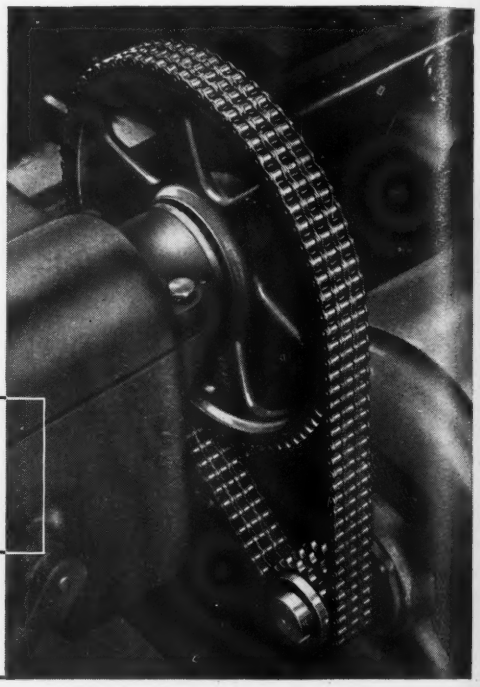
For conversions or new equipment specify **RENOLD stock chain drives.** Quiet, positive and smooth running, they will give you years of dependable, trouble-free service, outlasting other types of transmission many times.

Drives from fractional to 140 h.p. can be supplied **FROM STOCK** in 25 different ratios, easily selected from chart in our Catalogue Ref. 116/93



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Only 17 in. centres could be allowed for this drive from motor to heavy lathe — and only a Renold stock chain drive could transmit the necessary power at such short centres.

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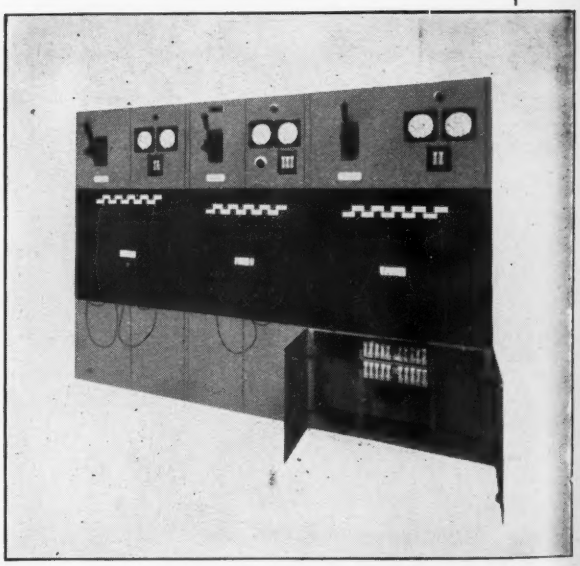
•

Switchboards of the type illustrated have been developed for use in large technical colleges and similar establishments where it is necessary to provide a variety of power supplies for the wide range of experimental work carried out in the electrical departments. This particular board caters for single and three phase A.C. and two/three wire D.C. at various voltages. Flexible leads plugged into the face of the switchboard enable any supply to be fed to any required bench or machine.

The Company invites enquiries for further information about this equipment and will gladly arrange for a technical representative to discuss details with any interested person.



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PERFORATED METAL

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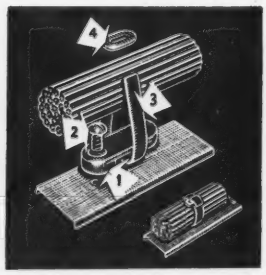
The BETA System

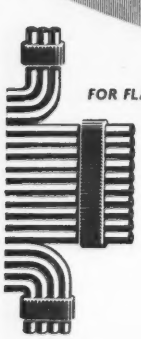
FOR ALL CONTROL WIRING

FOR BUNCHED CABLES USING **FOUR** *COMPONENTS ONLY*



1 A BETA moulded saddle
2 A standard screw.
3 A length of BETA strip.
4 A BETA buckle.

- Can be used on any type of support which will take a screw
- Will accommodate any number of cables.
- The BETA Strip is plastic covered and will not damage the cable. IT WILL NOT STRETCH IN USE.
- The saddle and buckle are made from rigid P.V.C. and are non-hygroscopic and non-inflammable.
- Cables can be added or withdrawn to suit circuit modifications with a minimum of disturbance.



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FOR FLAT CABLE FORMATION

USE* BETA STRIP *WITHOUT SADDLES

For those who prefer cables laid in flat formation, BETA strip is used to clip around a metal support without the use of screws. A special tool is supplied. Full details of this and other methods of application will be sent on request.

SPECIAL CLOSING TOOL

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Variations of the diamond pattern are among the numerous lighting designs you can use with Philips " Gear-less ". This highly versatile lighting is available in all standard colours ana in the outstanding Warm White de Luxe – exclusive to Philips.

...just four of the ways you can use PHILIPS *"Gear-less"*

Philips " Gear-less " in a ' Flexible Ceiling ' system in a modern store.

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The combination of fluorescent and tungsten lighting is ideal for store work. And Philips " Gear-less " is so light in weight it's ideal for use on false ceilings, too.

–Britain's most versatile lighting

That's the wonderful thing about Philips " Gear-less " fluorescent lighting: you can use it in so many different lighting designs. For Philips " Gear-less " means a fluorescent tube and a tungsten ballast lamp in series — and the rest is up to you. You can put them close together. You can put them far apart. You can put all the tubes in one room and all the tungstens in another. And so on. And so on. But versatility is only *one* of the wonderful things about Philips " Gear-less ". Look how inexpensive it is — only £3.14.3 for a complete 4 ft. unit — and how easy to install and maintain. Then there's its extreme lightness in weight, which makes it so suitable for all sorts of new fluorescent applications. There's every reason, in fact, for *you* to write to Philips *today* for their leaflet on " Gear-less " fluorescent — Lighting Publication No. A.169.

PHILIPS ELECTRICAL LIMITED

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(LD877)

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DON'T TRUST TO LUCK ...
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Manufacturers of cables for aircraft, automobiles, shipping, house or factory wiring and for all industrial uses.
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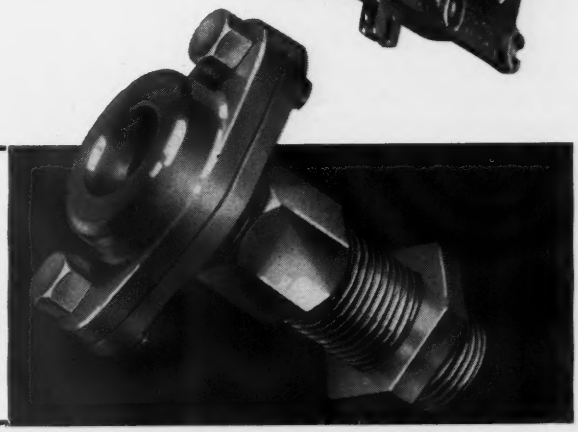
FLP perfect connection

Of Armoured Cables to any industrial Buxton Certified Flameproof equipment **WITHOUT** the use of Sealing Boxes . . .

NEW Walsall



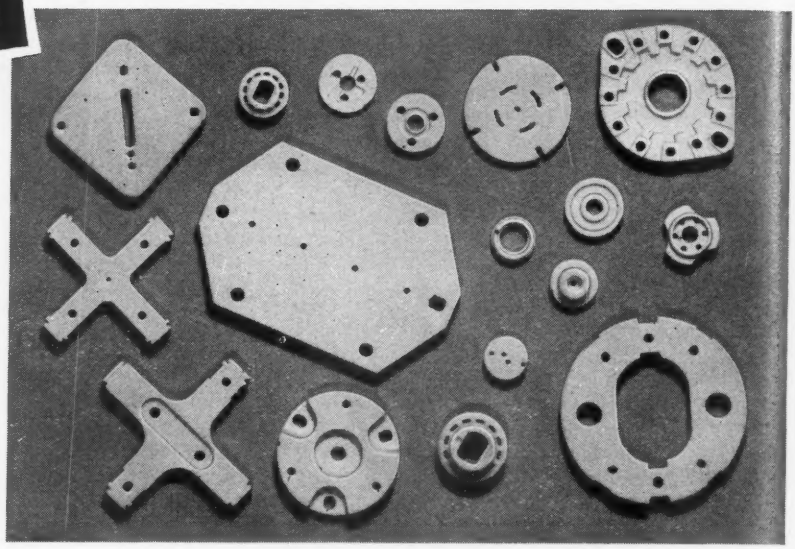
Cable Glands

BUXTON CERTIFIED GROUPS II & III CERTIFICATE No. FLP 3723 & 4

Suitable for V.I.R. or Plastic Insulated and Armoured Cables for use WITHOUT Compound Sealing Boxes. Approved for use where site conditions do not necessitate compound sealing of the cable insulant. Leaflet No FLP 51/4 available upon request.

WALSALL CONDUITS LIMITED · EXCELSIOR WORKS · WEST BROMWICH

BRAY electro-ceramic insulators



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Glass Reinforced Plastics

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2nd EDITION NOW READY

Many developments in the field of glass reinforced plastics have called for considerable changes in this important book — first published in 1954 and already twice reprinted. The text has been largely re-written and three new chapters have been added, thus bringing together all the latest information about the raw materials, fabrication techniques and specialised applications. This new edition is of the utmost importance not only to the plastics industry but to the many other industries which are making increasing use of glass reinforced plastics.

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2nd edition. 9¾" x 6". 326 pages inc. 50 art plates and numerous text illustrations. **45s. 0d.** *by post* 46*s.* 6*d.*

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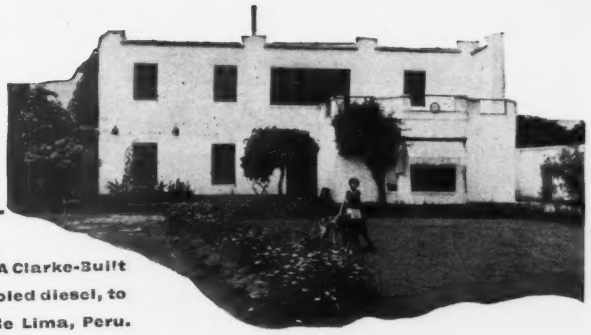
. . . on a farm in Peru



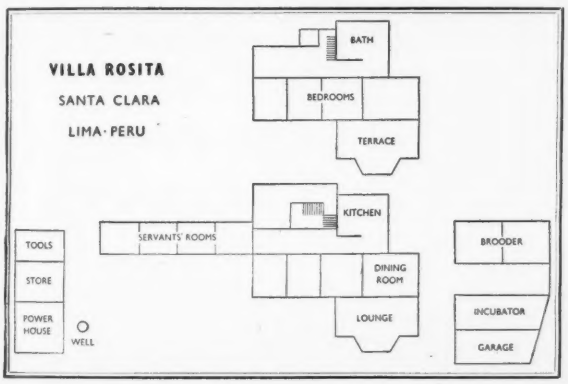
Three years ago, Mr. H. Kent Atkinson purchased an 8-KVA Clarke-Built generating set with Armstrong Siddeley 2-cylinder air-cooled diesel, to operate lighting and plant on his chicken farm outside Lima, Peru. These are extracts from a recent letter from Mr. Atkinson:

Instant starting

"The set is equipped with electric starting from a 12-volt car-type battery, with two remote-control stations in the house which is situated about 40 direct yards from the "power house". Any time that power is required in the house, my wife or servants have only to push the button in the kitchen downstairs or in the master bedroom upstairs, and the plant starts up automatically."

10,000 hours without replacing a part

"The plant has now run over 10,000 hours in the three years' service and has not had one single part replaced through wear. It is never necessary to add oil to the crankcase between drain-and-refill periods."



Seven months continuous running

"For one period of incubating and chick-rearing, the plant was running continuously for seven months. On this continuous service it was found necessary only to change the oil, etc. every 400 hours. This regular maintenance job takes one hour's attention per month and is practically all the attention the plant calls for.

"The cylinder heads have been removed only twice in the three years for the cleaning of carbon from the heads and piston crowns and for grinding-in the valves—these "decokes" were not done because of signs of distress from the engine. The job took six hours in each case with no outside assistance.

"The electric household and workshop appliances have multiplied enormously since the installation of this set and now include the following (in addition to some 40 lights):—

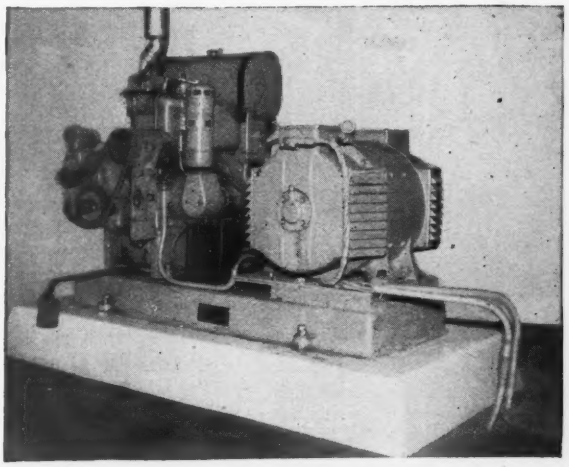
2 WATER HEATERS • WASHING MACHINE • 2 ELECTRIC IRONS
WAFFLE IRON • GRAMOPHONE PICK-UP • 2 FANS
DEEP WELL WATER PUMP • FUEL PUMP FROM BULK SUPPLY TANK
ELECTRIC MIXER • ELECTRIC BROILER • VACUUM CLEANER
FLOOR POLISHER • 3 ELECTRIC FIRES • MOVIE PROJECTOR
RADIO • TAPE RECORDER • ELECTRIC RAZOR • SOLDERING IRON
INCUBATOR • INFRA-RED CHICK REARERS • CHAFF-CUTTER
ELECTRIC WELDER • GRINDING & BUFFING WHEELS • CIRCULAR SAW
PAINT SPRAYER • FLEXIBLE SHAFT TOOL-HOLDER

"Whilst it is true that all these appliances can never be in use at the same time, the engine always has plenty of power and has never shown signs of over-heating.

"I have no hesitation in recommending the air-cooled Armstrong Siddeley unit to anyone who is away from municipal power supplies."

This record of reliability can be repeated in every one of the scores of industries in which Armstrong Siddeley Air-Cooled Diesels provide power.

THREE MODELS FROM 6 TO 33 H.P. SEND NOW FOR LEAFLETS

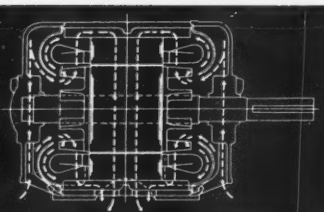


The generating set in situ at the Lima farm

ARMSTRONG SIDDELEY (BROCKWORTH) LTD
HUCCLECOTE • GLOUCESTER
TELEPHONE: GLOUCESTER 21531 • TELEGRAMS: BROCKARM, GLOUCESTER

These new, smaller motors *pack more power!*

AVAILABLE FROM STOCK!



Typical Airflow Arrangement. A.C. Squirrel Cage Ventilated Motor Series 5

Crompton Parkinson Series 5 motors are three phase, A.C. motors—conforming to a new draft BS for dimensional details and to BS 2613: 1957 electrically for Class E insulation.

By designing a new range in the light of modern materials, modern theoretical knowledge and modern manufacturing techniques, Crompton Parkinson have been able to pack more power into a given space than has hitherto been possible.

Note these points :

- **THEY ARE AVAILABLE FROM STOCK UP TO 7½ h.p. 1400 r.p.m. AND 5 h.p. 940 r.p.m.**
- THEY COST LESS.
- Cool air is drawn over the bearings at *both* ends.
- The stator case is isolated from the carcase by a stream of cool air.
- The shields, which direct the air over the bearings, also provide complete protection for the end-windings.
- The large central outlets in the sides and between the motor feet allow the cooling air to leave at low velocity and diffuse gently into the atmosphere.
- They conform to British Standards—performance and dimensions.

What the series 5 range covers

POWERS: 1 h.p. to 50 h.p.

SPEEDS: 2, 4, 6 and 8 poles.

MOUNTINGS: Horizontal foot; Horizontal flange; Vertical flange; Vertical skirt base.

ELECTRICAL EQUIPMENT

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3 DAYS' FREE TRIAL OFFER

THE FACTORY ACT 1937 SAYS—

In case of "fire," alarms must be sounded which will be clearly audible to every operative throughout the building.

★ **To all Factory owners, electrical contractors and others who have the responsibility to decide what type of alarm and how many we make the above offer of our "M" type siren.**

★ **This has been designed to "cut through" all noise levels in factories. These sirens can be supplied to work on any voltage AC or DC.**

★ **Easily portable (weight 4 lbs.) and can be carried round to every department and plugged into any convenient lighting point so as to determine the number required for the whole factory.**

WAILERS: To produce the wailing note on the siren, a wailer can be supplied which can operate any number of sirens.

INDICATORS: Where it is desired to notify a central point where an alarm point has been operated we have electrically illuminated indicators. This, in addition to showing the position, will give an audible signal in any desired point, fire dept., engineers' office, etc. Fire calls can also be arranged to be transmitted direct to nearest Fire Station.

Our sirens, alarm pushes, and all our equipment are in accordance with the "British standards code of practice" and has the approval of Factory Inspectors.

INSTALLATION: We have representatives in all parts of the country who will call and advise you, and submit complete estimates. We will also on request send you full detailed diagrams to enable your own staff or local contractor to carry out the work.

Send to-day for list No. 59 and our offer of 3 days' Free Trial

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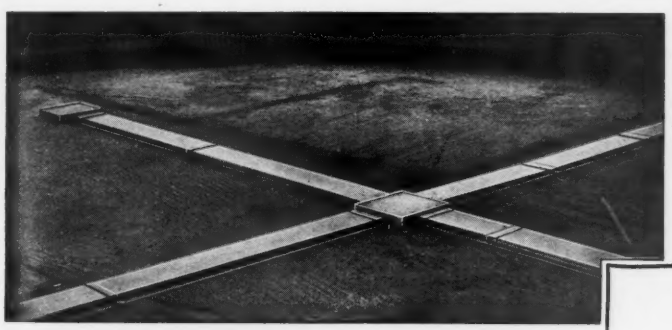

PURPOSE-MADE for every job

GREENWOOD-AIRVAC

UNDERFLOOR CONDUIT SYSTEM

For depths of screed 1½" and over
Rustproofed all-metal construction
Sizes from 4" x 1" to 12" x 1½"
Single or multiple divisions
One-way or multi-way junction boxes
Flyover separators if required
Floor outlets for future connections

Every contract for the Greenwood-Airvac Patent Conduit System is purpose made in that the duct size, junction box design and other accessories are made to suit the individual application although based on a standard pattern throughout. This elasticity of design enables this versatile system to meet all the requirements of architects and contractors to the mutual benefit of all concerned.

Full details are given in the publication 'Greenwood-Airvac-Conduit Systems' now available on request.

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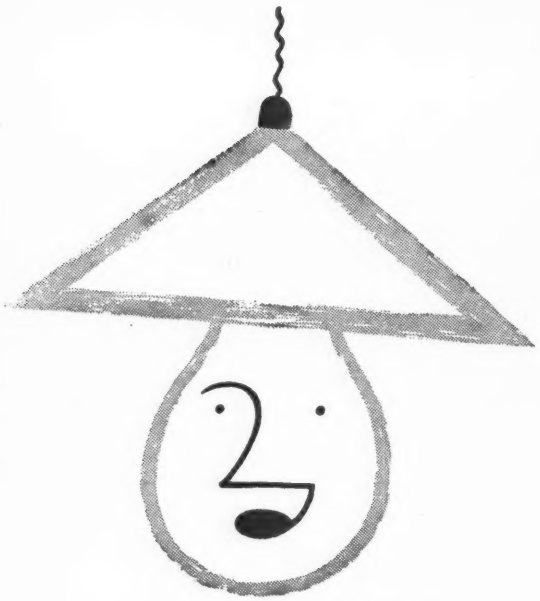


HEY!

I'M WASTING YOUR MONEY

I can't compete against sunlight, you know! In fact, I look so dim in daylight that they keep forgetting to switch me off. But I'm still bright enough to see that I'm wasting electricity! Why don't you fit a **SAVELITE?**

Why not, indeed? The 'Savelite' is a new photo-electric device which warns factory and office workers when to switch off unnecessary lights. Easily and cheaply installed in individual offices and workshops, it *cuts* electric light bills to the barest minimum, and saves its cost in a very short time.

A 'Savelite' is a neat little photo-electric unit that fits in the window and literally watches daylight and tells you when artificial lighting is not required. Take a walk round your works—it may surprise you to see how much money is being wasted on unnecessary lighting (lights which they have **forgotten** *to switch off!) The 'Savelite' unit costs only 23 Gns.—quickly saved out of your electricity bill. And remember—more light is wasted in the lighter months.*

CUT THOSE ELECTRICITY BILLS BY INSTALLING

SAVELITE

IT REACTS TO LIGHT AS A THERMOSTAT REACTS TO HEAT

Full details from

RADIOVISOR PARENT LTD., Stanhope Works, 61e, High Path, London, S.W.19 *Tel: CHErrywood 3351*

RADIOVISOR MAKERS OF ELECTRONIC CONTROLS SINCE 1927

2

Automatic Reversing Starter for single or three phase supply.
Motors up to 2½ h.p.
Alternative markings available.
(Ref. ART)

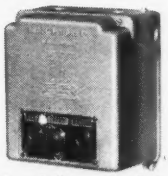
NEW BROOK

Small push button starter (Ref. HAT) for motors up to ½ h.p.

Silver contacts for long service. Minimum of parts ensures trouble-free working.

CONTROL GEAR

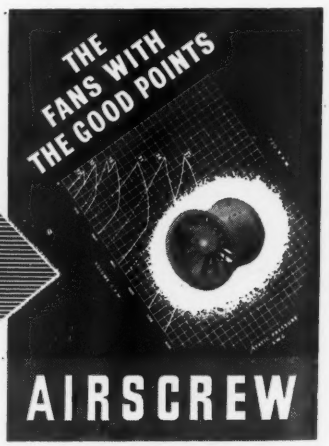
Automatic Two Speed Starter for three phase supply only.
Motors up to 5 h.p.
Alternative markings available.
(Ref. ADW)



BROOK MOTORS LTD · Huddersfield

57/S

well worth reading...



AIRSCREW

Have you read the Airscrew Axial Flow Fans leaflet.? It is interesting and informative.

The leaflet describes, in complete detail, the new *standardised* range of axial flow fans. When you read it you'll see why the Airscrew range is successful in so many industries.

Write for leaflet and address of your nearest Branch Office, to the Airscrew Co. & Jicwood Ltd. (Dept. ER) Weybridge, Surrey.

AIRSCREW

standard axials

Airscrew Axial Flow Fans offer you :

SHORTEST DELIVERY

LOWEST COST

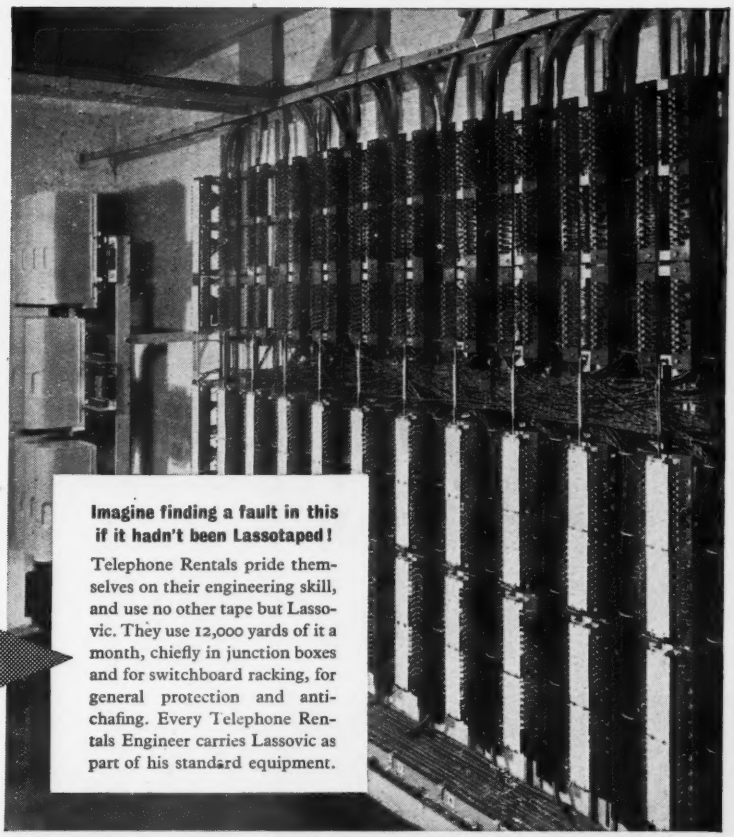
HIGHEST PERFORMANCE

GREATEST STANDARDISATION

EASIEST SELECTION

THE AIRSCREW CO. & JICWOOD LTD. (Dept. ER) WEYBRIDGE, SURREY

This is why TELEPHONE RENTALS



Imagine finding a fault in this if it hadn't been Lassotaped!

Telephone Rentals pride themselves on their engineering skill, and use no other tape but Lassovic. They use 12,000 yards of it a month, chiefly in junction boxes and for switchboard racking, for general protection and anti-chafing. Every Telephone Rentals Engineer carries Lassovic as part of his standard equipment.

and MURPHY RADIO

Corrosion is the danger: Lassothene is the answer

Any material that Murphy uses has to pass rigorous type approval tests in their Engineering Dept. They gave Lassothene good marks for high dialectric strength, low water absorption, and chemical purity. Here are components for a portable radio, and TV sets.

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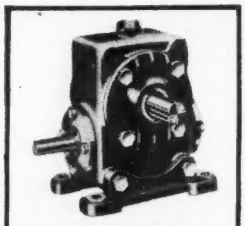
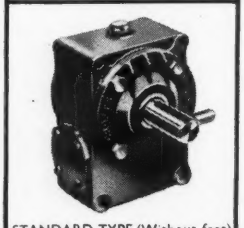
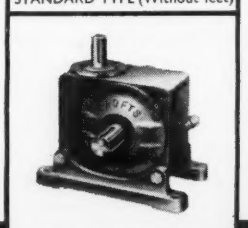
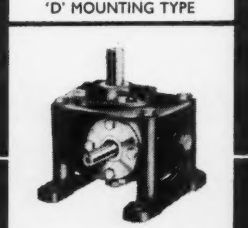
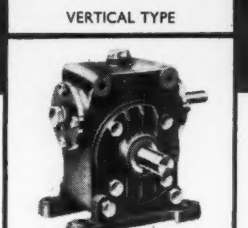
Crofts universal mounting worm reduction gears

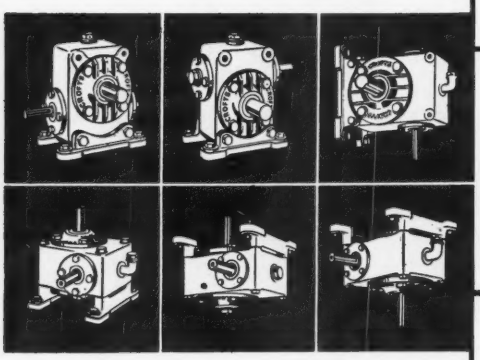

STANDARD TYPE

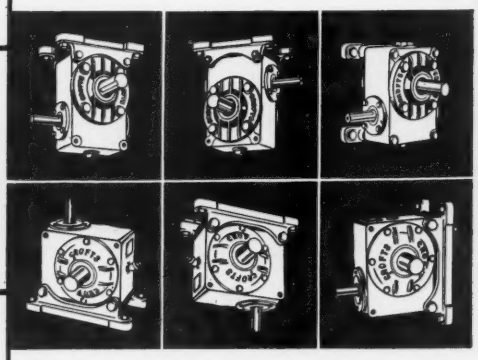

STANDARD TYPE (Without feet)


'D' MOUNTING TYPE


VERTICAL TYPE


INVERTED TYPE





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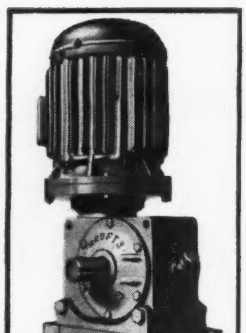
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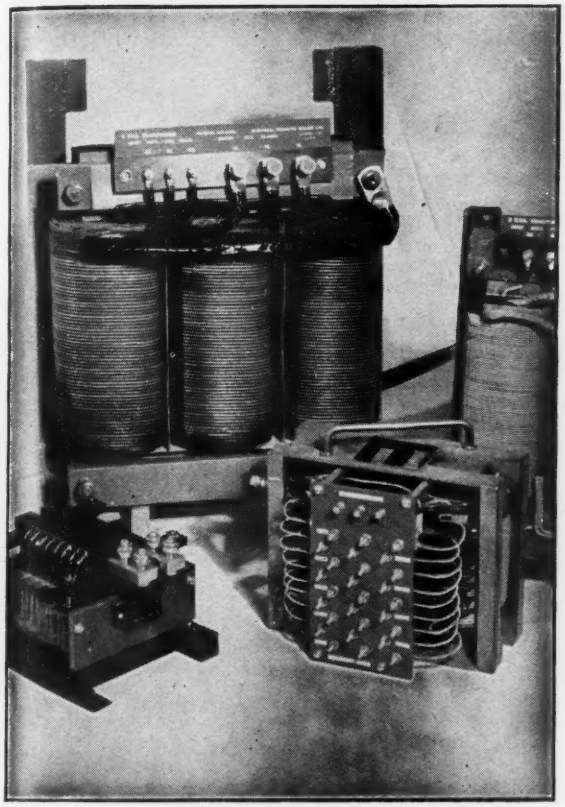

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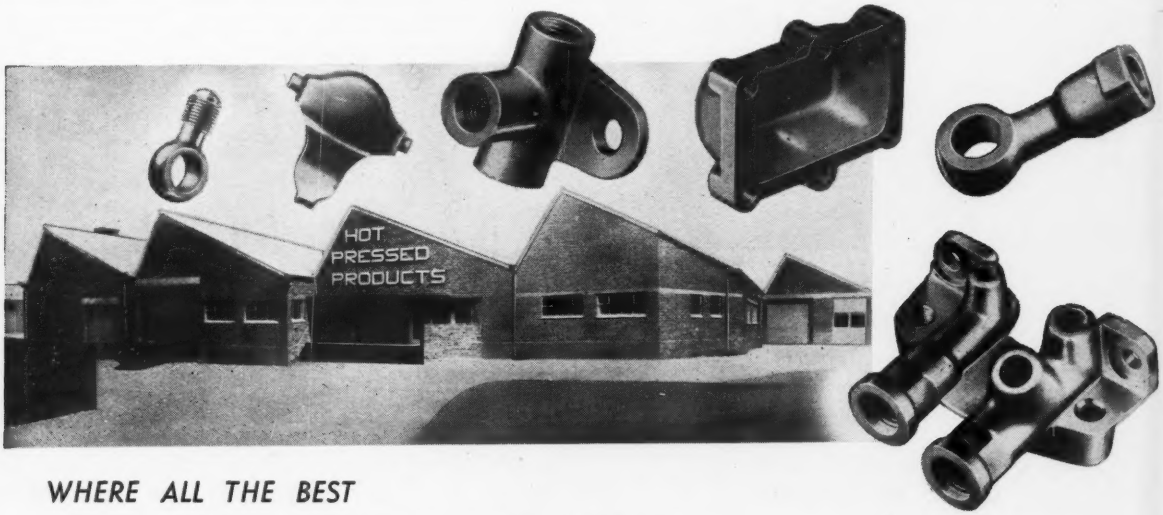

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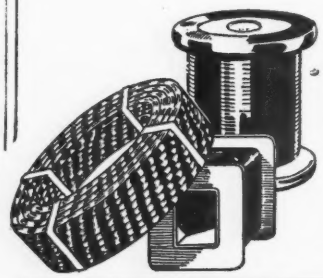

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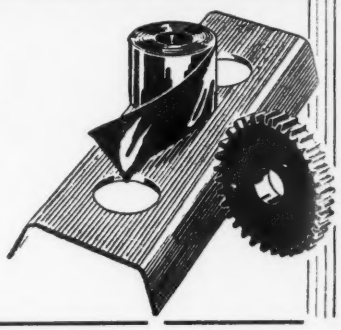

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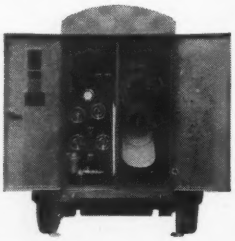

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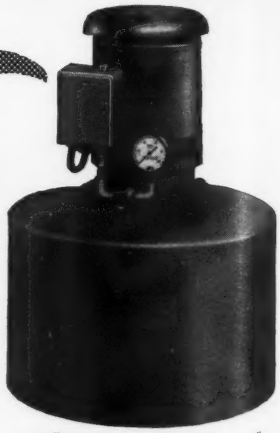

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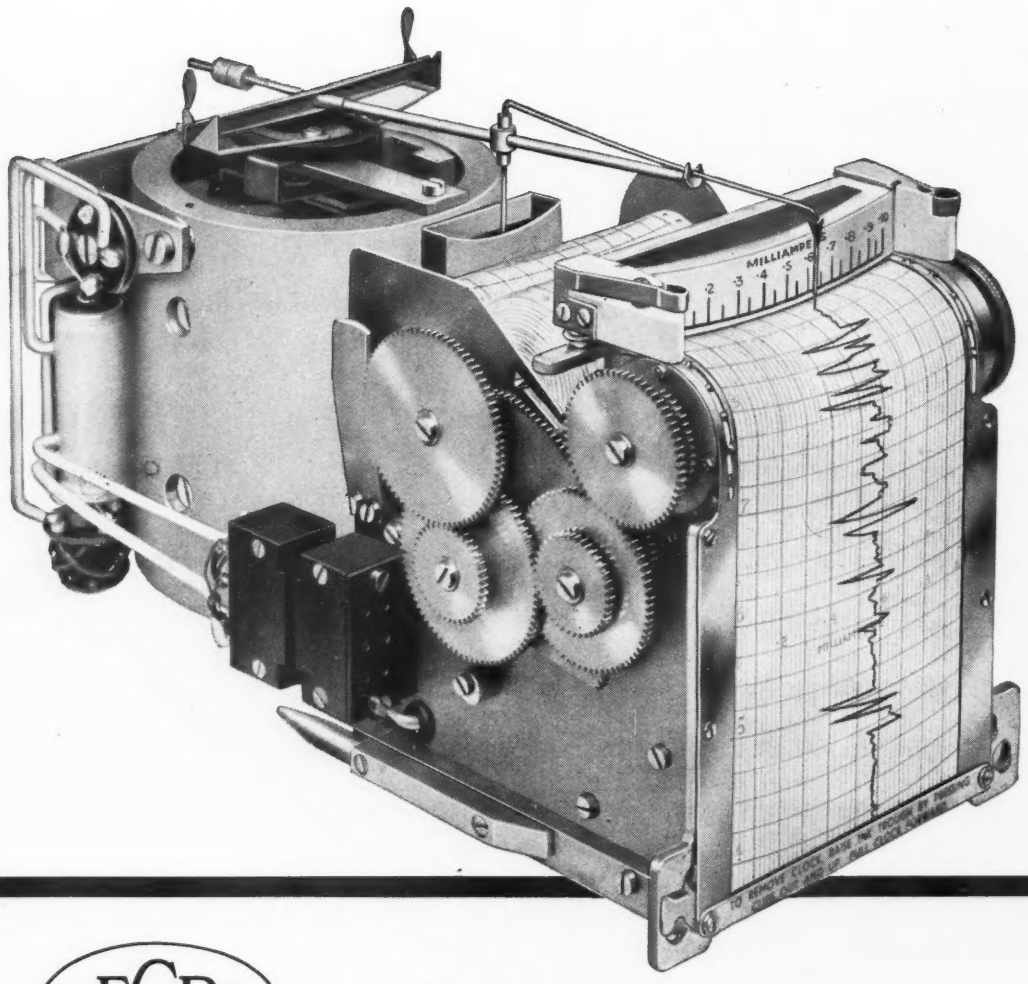

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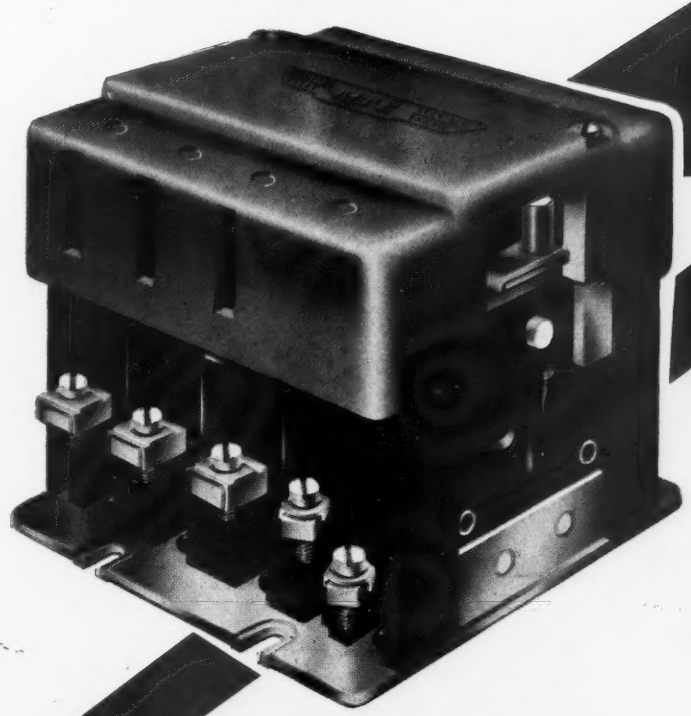

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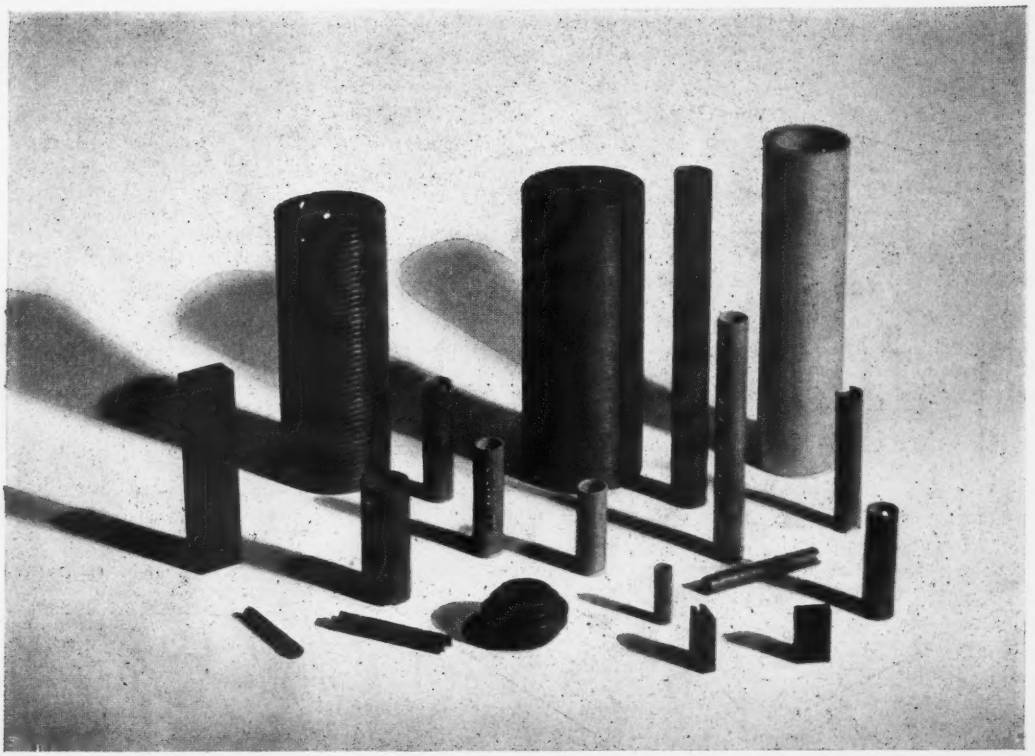

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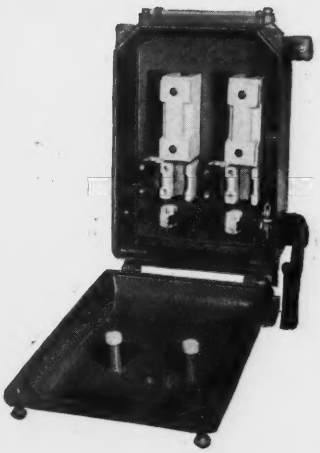

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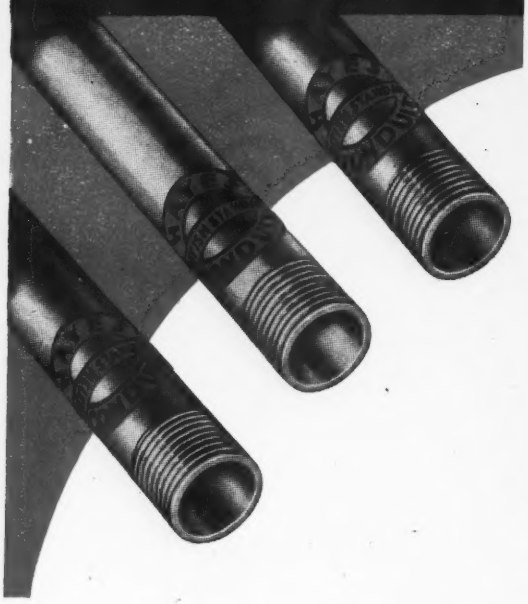

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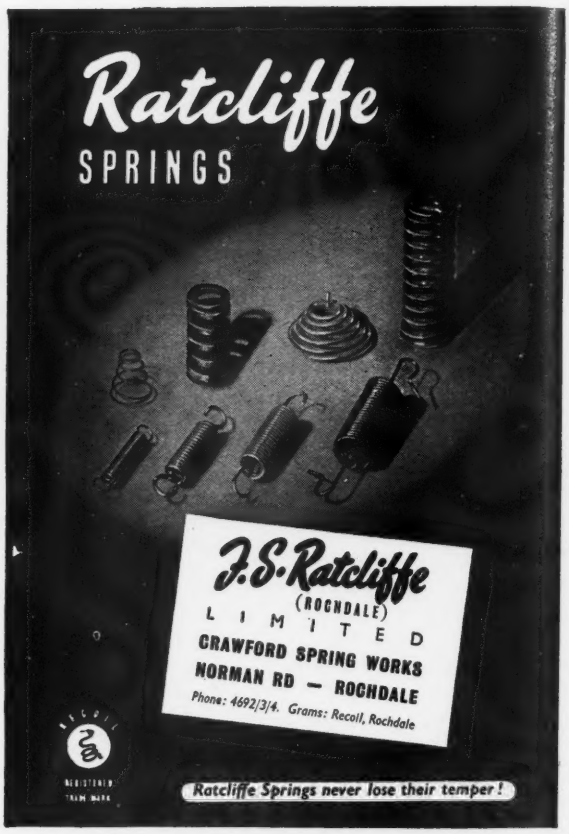

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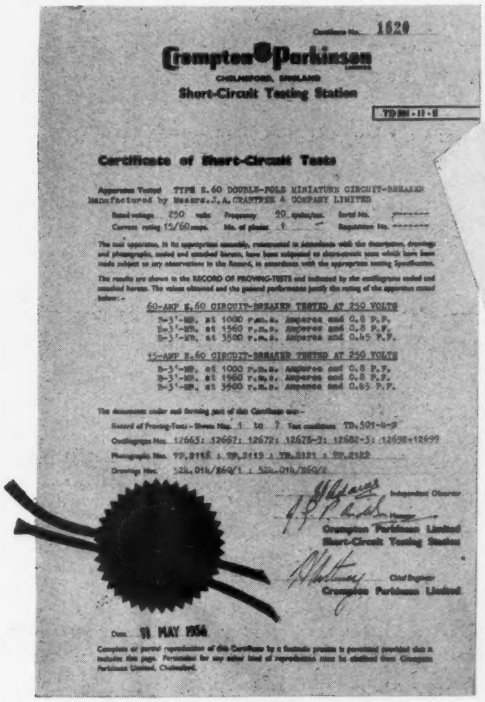

Certificate No. 1829

Crompton Parkinson

CHELMSFORD, ENGLAND

Short-Circuit Testing Station

Certificate of Short-Circuit Tests

Apparatus Tested TYPE E.60 DOUBLE-POLE MINIATURE CIRCUIT-BREAKER

Manufactured by Messrs. J. A. CRABTREE & COMPANY LIMITED

Rated voltage 250 volts Frequency 50 cycles/sec. Serial No. ———

Current rating 15/60 amps. No. of phases 1 Registration No. ———

The said apparatus, in its appropriate assembly, constructed in accordance with the descriptions, drawings and photographs, sealed and unsealed herein, have been subjected to short-circuit tests which have been made subject to any observations in the Record, in accordance with the appropriate testing Specification.

The results are shown in the RECORD OF PROVING-TESTS and indicated by the oscillograms sealed and unsealed herein. The values obtained and the general performance justify the rating of the apparatus stated below:-

60-AMP E.60 CIRCUIT-BREAKER TESTED AT 250 VOLTS

3-31-MP. at 1000 r.m.s. Amperes and 0.8 P.F.
3-31-MP. at 1960 r.m.s. Amperes and 0.8 P.F.
3-31-MP. at 3500 r.m.s. Amperes and 0.45 P.F.

15-AMP E.60 CIRCUIT-BREAKER TESTED AT 250 VOLTS

3-31-MP. at 1000 r.m.s. Amperes and 0.8 P.F.
3-31-MP. at 1960 r.m.s. Amperes and 0.8 P.F.
3-31-MP. at 3500 r.m.s. Amperes and 0.65 P.F.

The documents under and forming part of this Certificate are:-

Record of Proving-Tests - Sheets Nos. 1 to 7 Test conditions TD.501-A-9

Oscillograms Nos. 12665; 12667; 12672; 12675-5; 12682-5; 12698+12699

Photographs Nos. TP.2115 & TP.2119 & TP.2121 & TP.2122

Drawing Nos. 52A.016/E60/1 & 52A.016/E60/2

Independent Observer

Crompton Parkinson Limited
Short-Circuit Testing Station

Chief Engineer
Crompton Parkinson Limited

Date 31 MAY 1954

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Certified by A.S.T.A. Approved Testing Station

Certified rupturing capacities :

(250 volt) : 3,500 amp. R.M.S. (·45 p.f.)

(500 volt) : 3,000 amp. R.M.S. (·60 p.f.)

The TYPE E·60 EARTH-LEAKAGE CIRCUIT BREAKER

The excellent rupturing capacity of the Type E-60 earth-leakage circuit-breaker is achieved by enclosing de-ion arc-quenching grids in special arcing chambers which are completely isolated from each other and from the operating mechanism. Publication No. 1179, available on request, contains details of this and the many other important features designed to give you new and better earth-leakage protection.

NEW *AND BETTER* EARTH-LEAKAGE PROTECTION BY CRABTREE

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SPECIALITÉ DE LA MAISON

CHILTON'S own particular speciality is Circuit Protection—in fact, they have built a whole business on it. By specialising over many years they have accumulated a unique fund of experience, which is evident in the efficiency and reliability of CHILTON Circuit Breakers and Earth Leakage Trips.

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CHILTON EARTH LEAKAGE TRIPS *Type ELT/A (without overload protection)* —Robust Double Pole Unit built in accordance with BS:842:1939. Suitable for all current ratings up to and including 60 amps. at 250v. A.C.
Type ELT/B (with overload protection)—Incorporates thermal time lag overload protection and instantaneous short circuit protection. Earth leakage tripping mechanism unaffected by long periods of inactivity in dirty, greasy or damp conditions.

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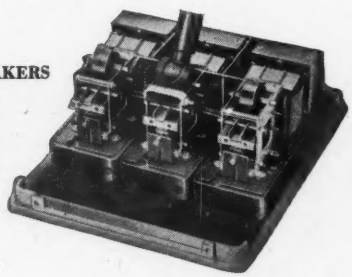
Safe and efficient under all load conditions. In Single, Double, Triple or Four Pole frame sizes, in plastic (single pole only), die-cast aluminium or sheet steel cases. Standard Ratings: ½, 2½, 5, 10, 15, 30, 40, 50 and 60 amps. All handles trip free. Normally fitted with both thermal time lag overload and magnetic short circuit tripping.



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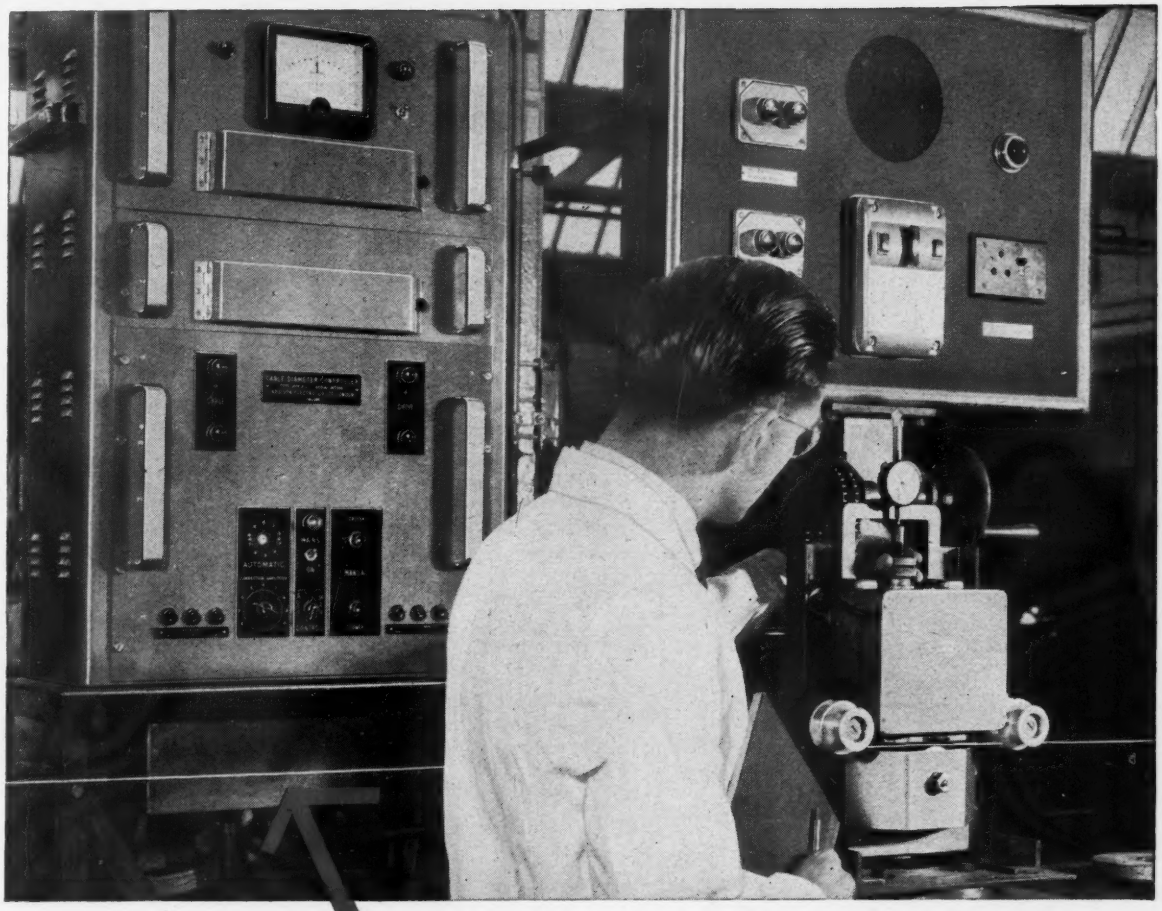
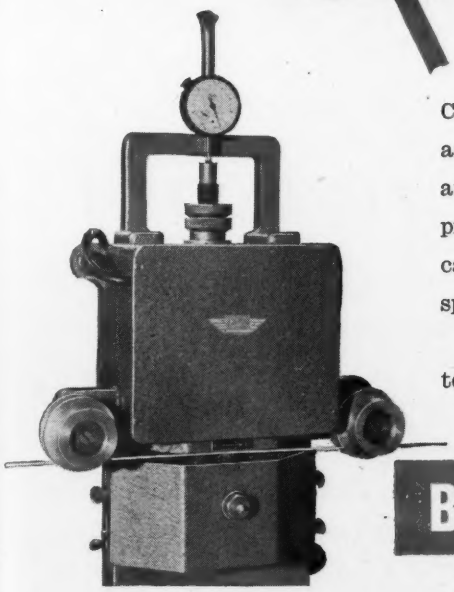


Made to Measure



Installed in the production line, this Diameter Controller continuously measures the cable diameter as the insulation or sheathing is applied and automatically corrects any variation from the required pre-set dimensions. By this means precise control of cable diameter and rigid compliance with dimensional specifications are ensured.

Just one of the ways in which BICC quality control techniques guarantee cables that you can depend on.

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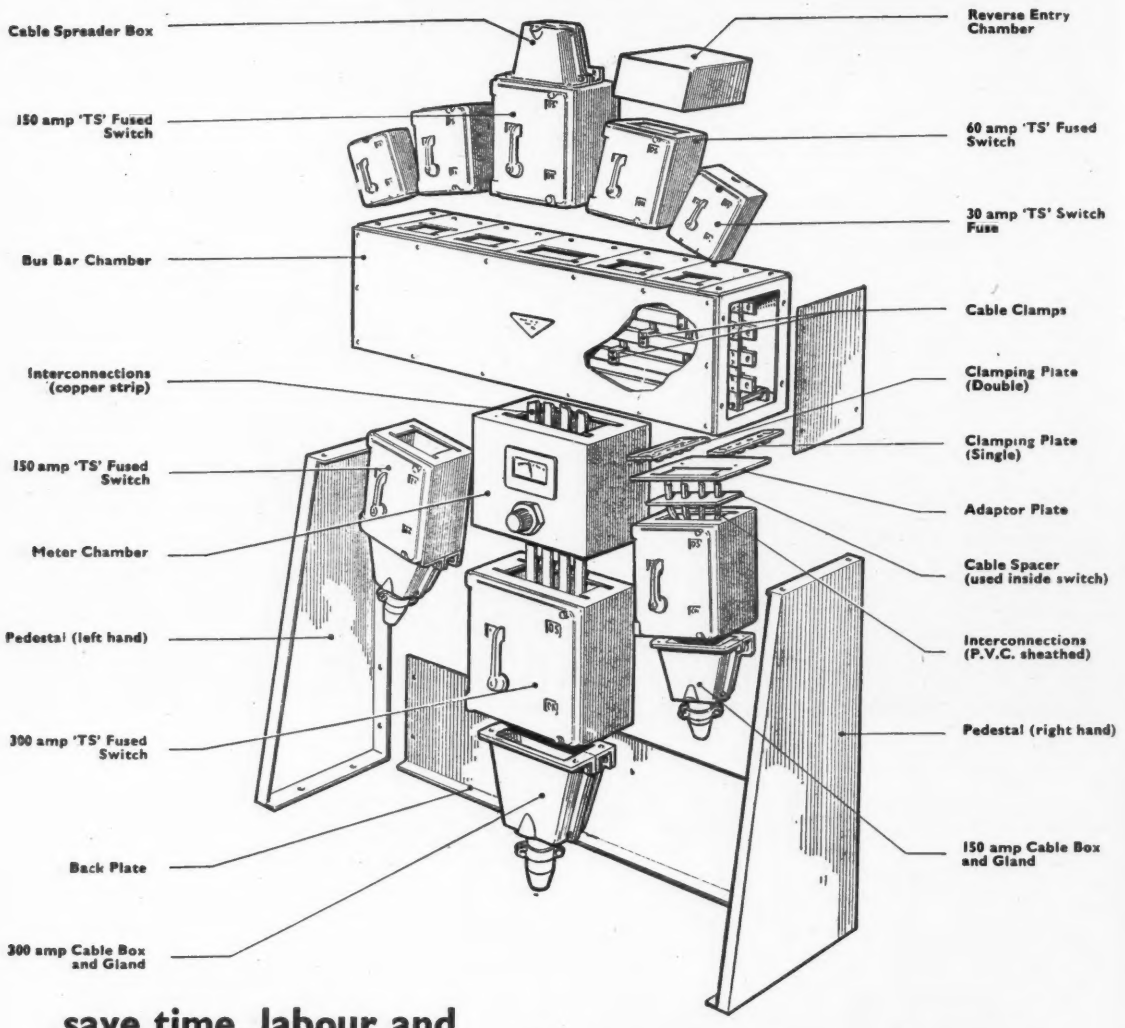

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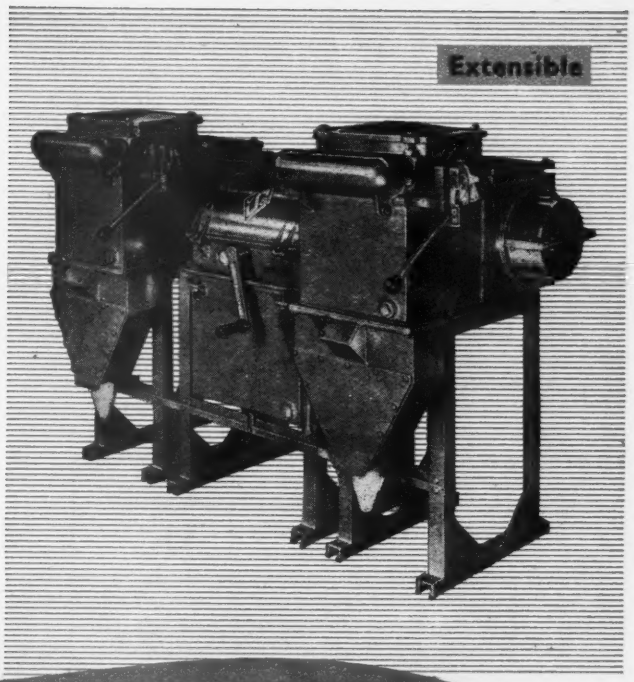

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Rupturing capacity 250 MVA ASTA. Tested at both 6.6. and 11 kV with fault making load breaking isolators.

Impulse tested

Rust proof finish if required for outdoor installation.

Many different arrangements available including transformer mounting and for incorporation in switchboards with Oil Circuit Breaker Units.

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The following can be fitted if required:

Spare fuse container. Ammeter. Potential indicator. Shunt trip. Earth Leakage trip. Earthing and/or testing device for Fuse Switch. Metering Unit with Voltage and current transformers.

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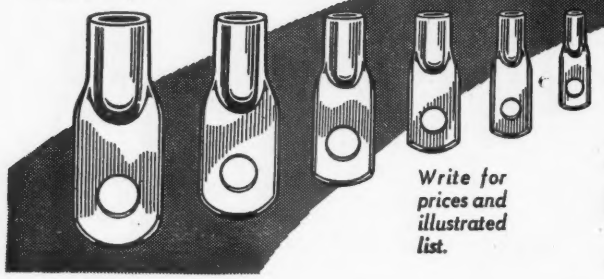

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15 amps. DIPPED TINNED

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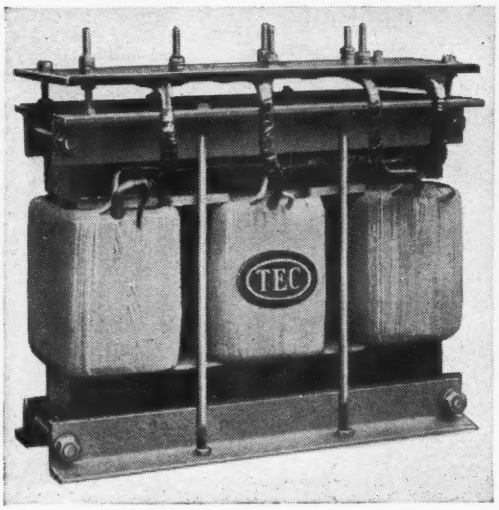

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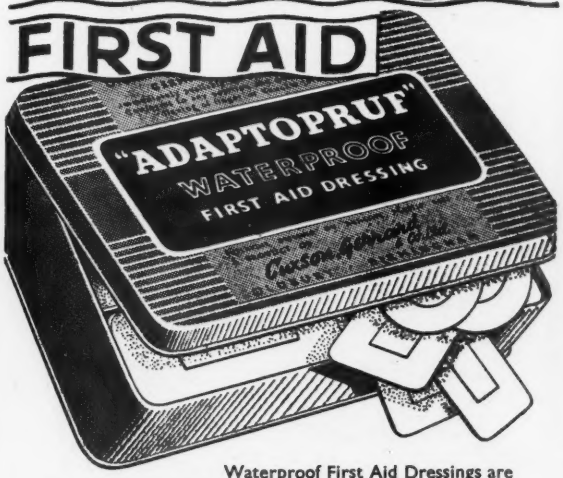

Waterproof First Aid Dressings are intended for use when a wound is exposed to water, or contamination from oil, dirt, etc., and also where necessitated by hygienic requirements.

Illustrated is our most popular assortment of such dressings (Adaptopruf No. M207) consisting of 114 adhesive plasters of five different sizes. Each has a dressing pad of soothing, quick healing Euflavine, a most effective medicament equally for wounds *and* burns.

Whenever a waterproof plaster is not essential we recommend Adapt*oplast* First Aid Dressings be used.

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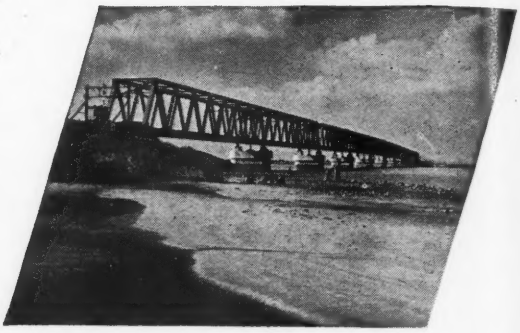

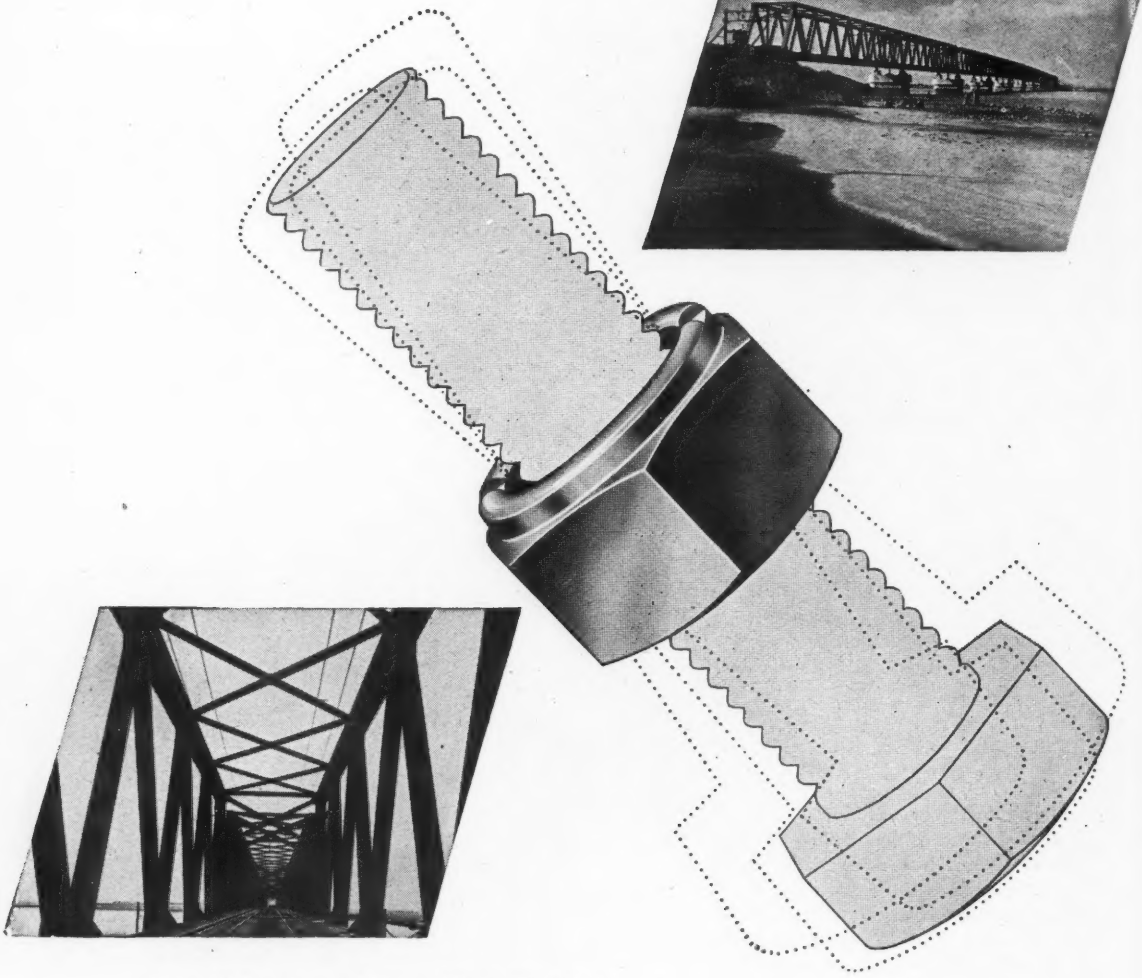

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Tough nuts, these Nylocs! Jerk them, jolt them, bump them,
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A quarter of a million Nylocs secure the main road and rail plates
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This bridge has five 200-metre spans, is 9·5 metres wide.
160 main line trains speed across from both directions
every 24 hours—but no amount of vibration
will relax the Nylocs' grip on the bolts.
The Nyloc with nylon insert, the all-metal Pinnacle
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ASTRAL FUSED SWITCHGEAR

160 Amp. rating, with cable dividing boxes fitted.

PERFORMANCE Tested by K.E.M.A. for: (a) *Short Circuit*. Making on 35 MVA Class AC5 fault. (b) *Make-and-break*. Type tests to relevant B.S.

RATINGS 60, 160 and 300 Amp., 440 Volt. Up to T.P. & N. For B.S. 88 H.R.C. AC5 Cartridge Fuse-links. Or with solid links, as isolators.

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Arcolectric components will help you to make a better product at less cost

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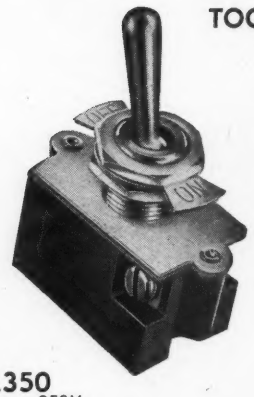
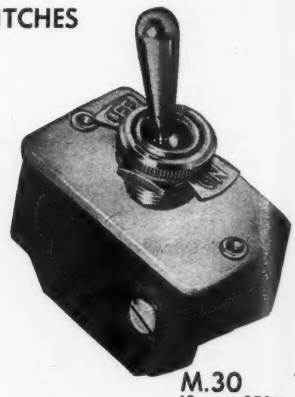
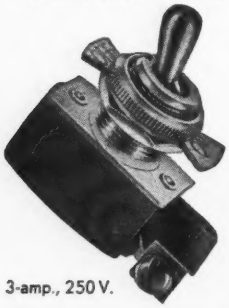


S.350
5-amp., 250V.



M.30
10-amp., 250V.

MINIATURE TOGGLE SWITCHES



3-amp., 250V.

Arcolectric are the largest British manufacturers of miniature toggle switches

G.600
screw terminals

T.600
solder tags

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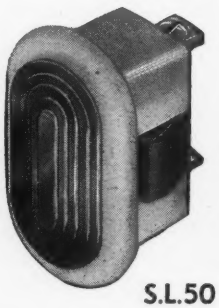
actual size

Mains voltage signal lamp for 15 watt B.C. Pigmy lamps. Also available with 3-slot holder.



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Neon signal lamp for all mains voltages. Snap-in fixing.

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Neon signal lamp for all mains voltages. Single $\frac{1}{2}$" hole fixing.

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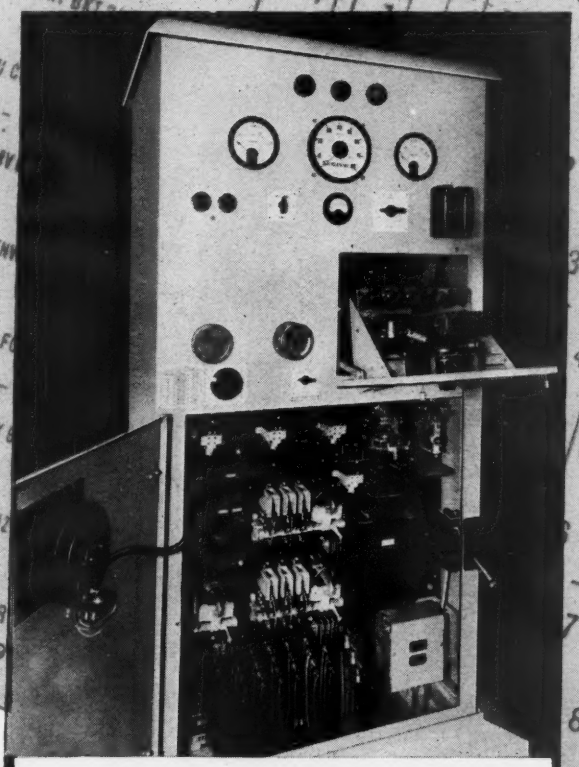
universal power plant



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Input	*400 volts 50 cycles 3 phase*
Output	*10 kVA single phase*
Voltage range	*100/250 controlled ± 3%*
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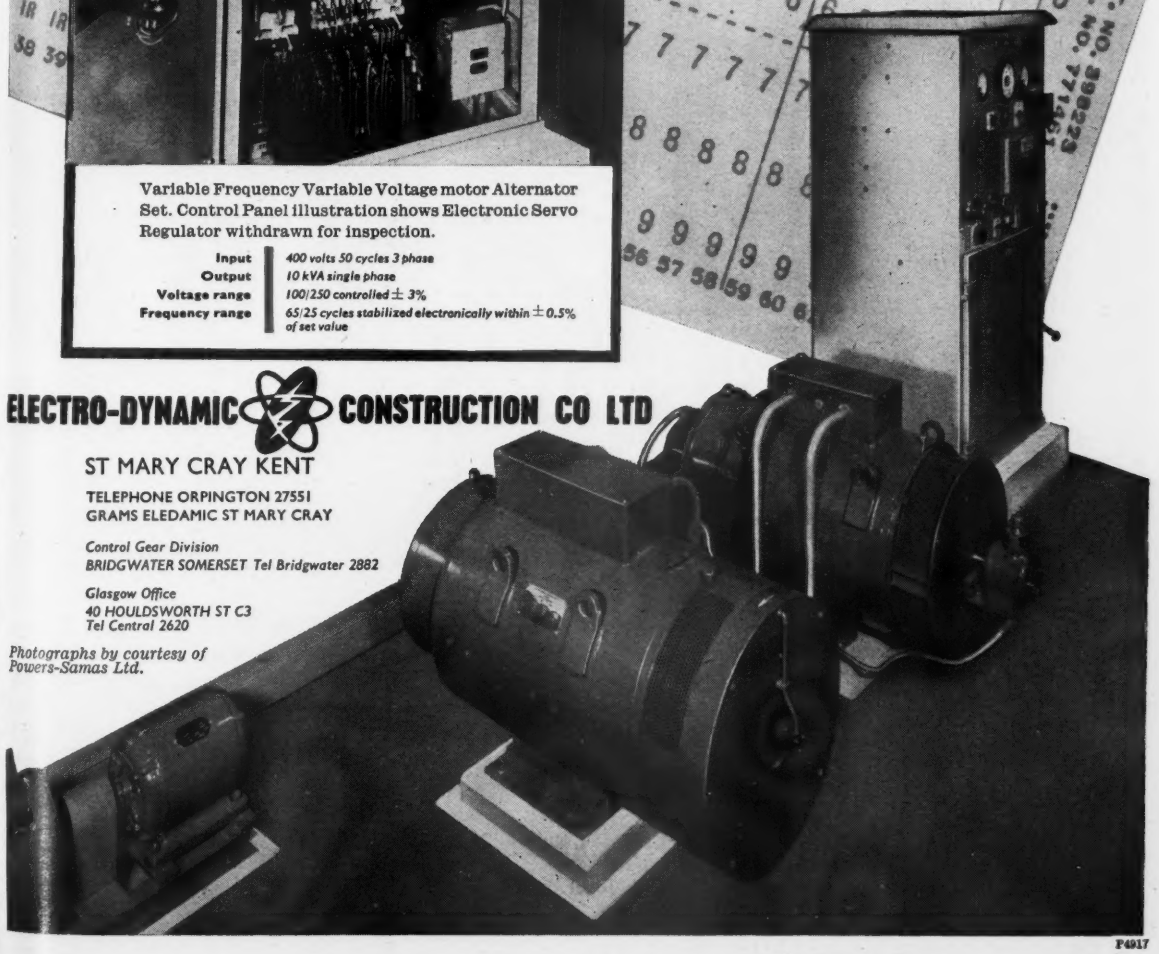

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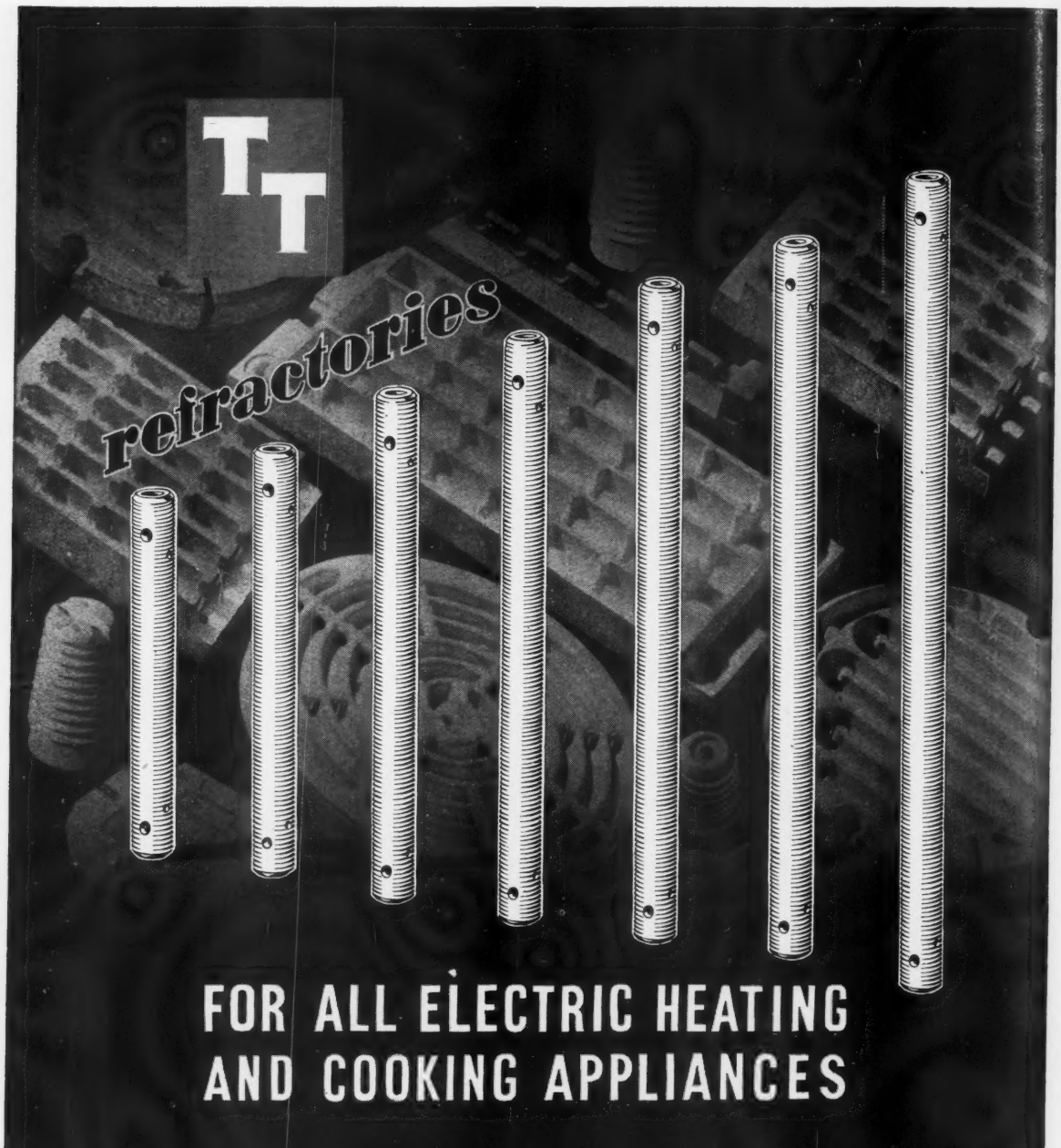

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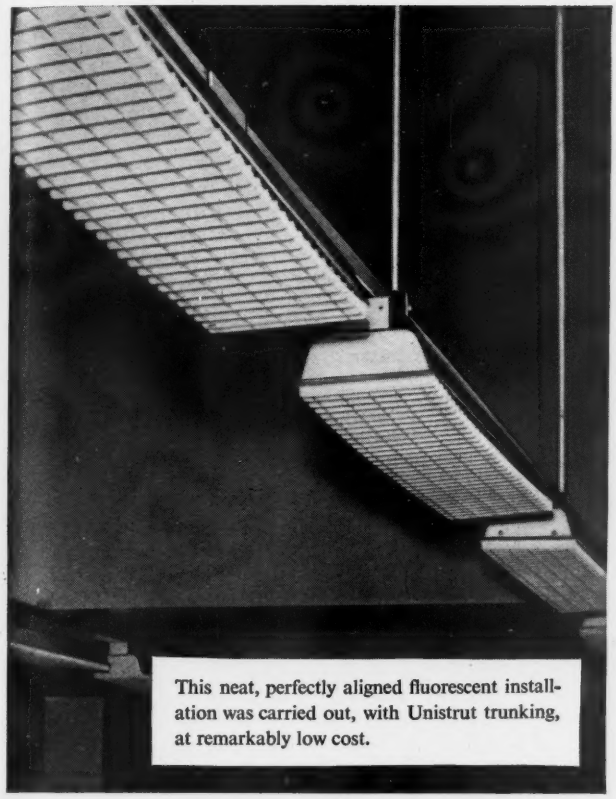
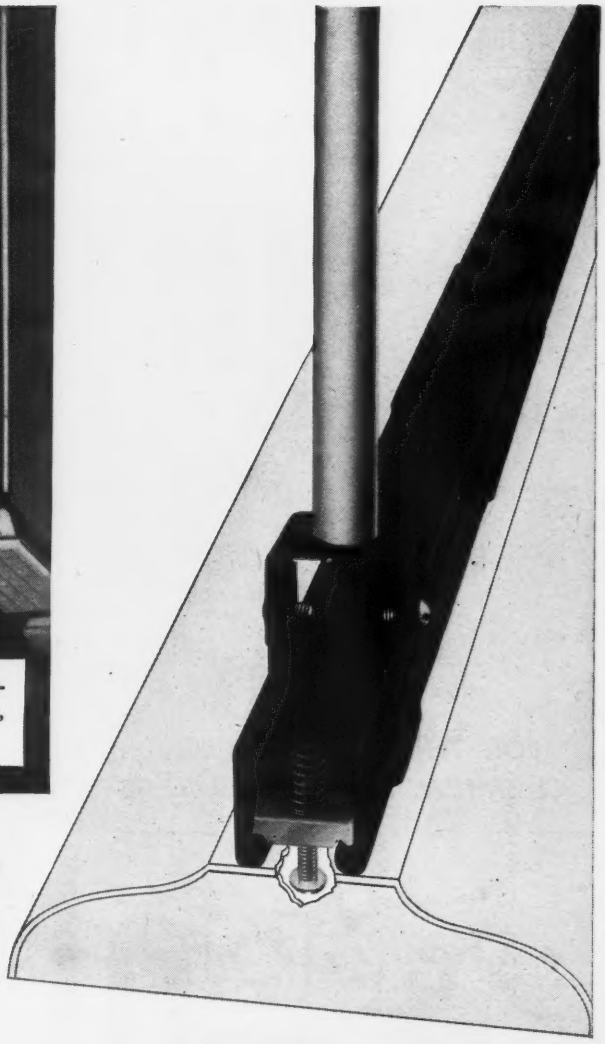


This neat, perfectly aligned fluorescent installation was carried out, with Unistrut trunking, at remarkably low cost.



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For fluorescent installations—everywhere

The cheapest method for continuous trunking of fluorescent fittings is also the *best*—fastest, safest, *and* neatest. The special channel section offers greater resistance to deflection, and allows long runs to be assembled and hung with unusually few hangers. The *self-locating* Unistrut nut, in combination with the continuous-entry channel, adds a facility for future repositioning of the fittings, in situ, to the *immediate* advantage of rapid, positive assembly. The finished job is extremely neat, with concealed wiring and perfect alignment of the fittings. Maximum economy is effected by rapid erection without drilling, etc., using only 5 standard components.

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46 Cannon St., London, E.C.4. Telephone: City 4477.
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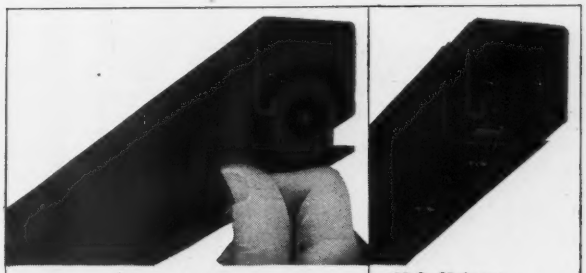

Clip-on cover protects against dust and damage, completes the installations neat appearance.

20 ft. Unistrut channels are quickly joined to make desired span.

HOW UNISTRUT GIVES CONTINUOUS SPAN... PERFECT ALIGNMENT... COMPLETE SECURITY

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Specially designed for reliability and long trouble-free service.

A variety of shapes permits the heating of circular, oval, square or other regular formed metal parts.

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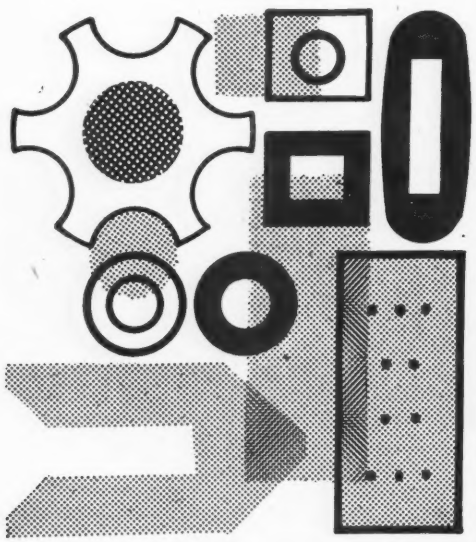

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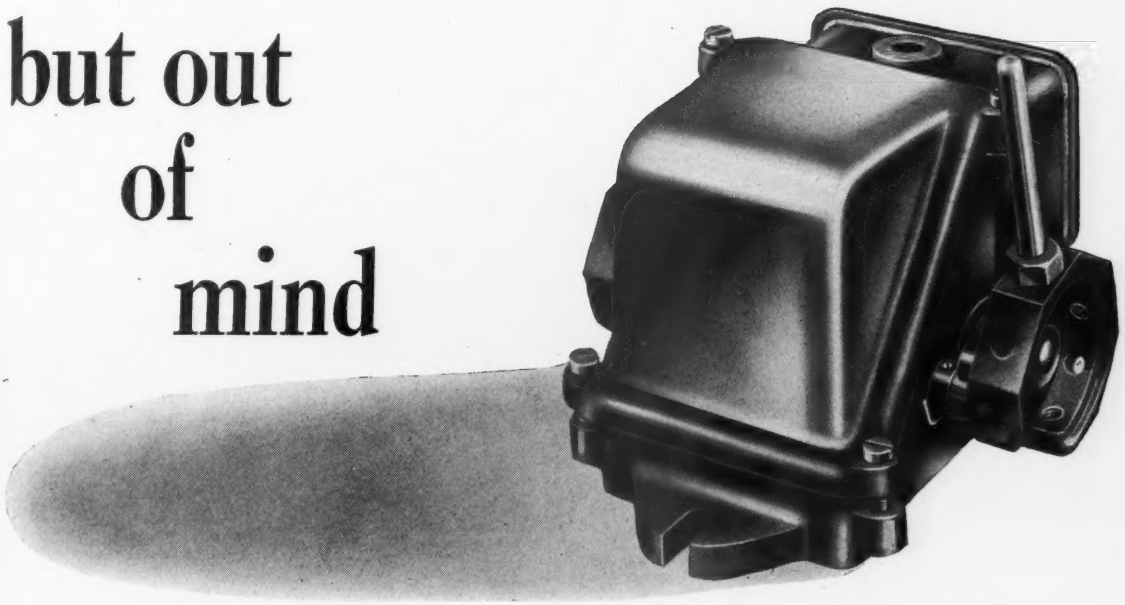
but out of mind



Even when it has been standing unused for a long time, an Ellison tappet operated limit switch gives instantaneous response in an emergency. Whether intended for long periods of idleness, or required for frequent operation, Ellison limit switches can be relied upon to work with certainty. Whatever the use or the time, you will be glad that you installed an Ellison limit switch.

Write for List No. 11 for details and illustrations of the Ellison range of limit switches and emergency trip switches.

ELLISON SHUNT LIMIT SWITCH (AC OR DC)
Current carrying capacity of 40 amps continuously. Breaking capacity at 440 volts of 10 amps non-inductive DC and 80 amps AC for single-pole and approximately three times these figures for double-pole.

A.C. SERIES LIMIT SWITCH
Double-pole for maximum current carrying capacities of 75 and 150 amps at 660 volts.

D.C. SERIES LIMIT SWITCH
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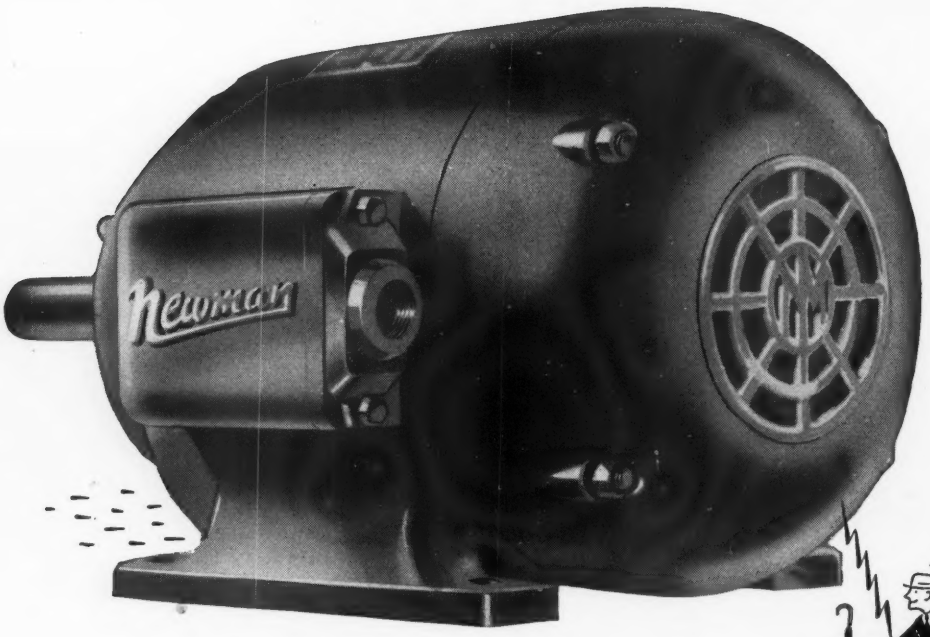

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12 JULY
1957

ELECTRICAL REVIEW

Managing Editor: HUGH S. POCOCK, M.I.E.E. *General Editor:* J. H. COSENS *Technical Editor:* P. W. TUCKER, M.I.E.E.

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ELECTRICAL REVIEW

12 July 1957 Vol. 161 No. 2 Established 1872

Boiler Circulation Theory

EIGHT years ago the Department of Engineering in the University of Cambridge began experimental work related to theoretical studies on the rate of circulation in a simple steam boiler circuit. This work was extended in 1951 when the Water-Tube Boilermakers' Association sponsored an experimental research project which had been proposed by the University with the object of studying the pressure drop and flow conditions of a steam-water mixture flowing along heated and unheated tubes at pressures up to the critical pressure of steam. The project (which is dealt with on page 58) is thus of a major nature relating as it does to the fundamentals of circulation theory in high pressure boilers and other types of evaporative heat exchangers. Although the project is being sponsored by the Water-Tube Boilermakers' Association the actual research work is being carried out by the Cambridge University Department of Engineering. This provides an outstanding example of the close co-operation between a university and an industrial organisation.

Studies are being made of the effects of several variables, including pressure, heat input rate, internal diameter and inclination of test section, the velocity of the water entering the heated test section and the dryness fraction of the emergent steam. To afford control over all the variables, assisted circulation has been adopted, so that the velocity of the entering water is independent of the heat output. This also permits of direct determination of the friction coefficient when circulating hot water alone at any pressure and rate of flow, before tests under conditions of steam generation. The test section itself is 24ft long, but the heaters have been designed to permit heating over 8, 16 or 24ft as may be desired. By this means the pressure drop in the unheated pipe following the heated portion of the test section can be measured at selected inclinations.

Before the present programme of research was launched very little data concerning boiler circulation had been obtained at pressures exceeding 100 lb/sq in. In view of the post-war trend towards the increasing use of higher pressure/temperature cycles for power production it has become essential to obtain a great deal more fundamental information over a wide range of pressure levels. The work being undertaken at Cambridge will undoubtedly be of great value to designers of high pressure boilers for power stations and also of heat exchangers for nuclear generating plants. It is likely

that the results may also be applicable to the design of water tube boilers for marine use.

To keep things in their right perspective it should be pointed out that although the experimental data resulting from this research project will be of inestimable value to the industry, the project is not expected to revolutionise the design of high pressure boilers. But the results obtained should provide a sound scientific basis for the assessment of present design methods, and so probably lead to improved steam raising plants.

BIGGER BOARD SALARIES

Last week's announcement by the Prime Minister that the salaries of chairmen and members of the boards of nationalised industries are to be raised will please not only the immediate beneficiaries but also the senior members of their staffs. Details of the increases are to be given in a White Paper. So far their nature has only been broadly indicated by Mr. Macmillan who said that the salaries of the chairmen of major boards would be raised from £8,500 to £10,000 and those of members of such boards from £5,000 to £7,000. The Central Electricity Authority falls within this category.

In the section of its report dealing with remuneration the Herbert Committee of Inquiry into the Electricity Supply Industry recommended that the salary of the chairman of its proposed Central Authority (the Electricity Council of the new Electricity Bill) should be at least £10,000 and that of members at least £8,500 in order to attract the best men. More than that, the increases of board members' salaries would permit the raising of the "ceiling" which the present levels imposed upon the remuneration of management and technical staffs.

There may be some protests about the increases but they will come from people who do not realise the scale of the boards' work in comparison with that of most private industrial concerns.

NIOBIUM

The need for reactor materials having low neutron absorption, ability to withstand very high temperatures without creep, and compatibility with uranium has stimulated the production of metals previously almost unknown outside a highly specialised field or regarded as scarce. Niobium, which has come into prominence as a probable canning material for the Dounreay fast breeder reactors, appears to meet the requirements stated above and to possess other desirable qualities, as set out by Dr. G. L. Miller in *The Times* of 3rd July. In this he refers to the recent discovery of large reserves in several countries, including Canada. Another important characteristic of niobium, as was shown at the Welding Conference (reported by us on 5th July), is that it can be welded to give good ductile joints, in which it is much superior to most metals having high melting points.

PARTICLE ACCELERATION

The tandem electrostatic generator which is being designed by the United Kingdom Atomic Energy Authority in collaboration with a large electrical manufacturing concern forms a valuable addition to the tools available to nuclear energy research workers. This machine, which is described on page 72, produces high energies which will permit the study of nuclear reactions produced by the bombardment of uranium and the trans-uranic elements. As a result, a considerable advance in our knowledge of the nuclear properties of these elements is to be expected.

By bombarding suitable light element targets with beams of protons and deuterons, it will be possible to produce neutrons of controllable energy in the range up to 30 MeV, and to study their interaction with other nuclei. This information is basic to our atomic energy programme, and is likely also to be of considerable fundamental interest. Other possibilities include the acceleration of heavier ions such as those of oxygen and fluorine. There is no doubt that the tandem machine will considerably extend the range of studies that can be carried out with electrostatic generators.

VACANT UNIVERSITY PLACES

According to a report published by the Association of Universities of the British Commonwealth, a committee of university vice-chancellors concluded recently that although it could fairly be claimed that no student in this country who was worthy of a university education would be denied one, out of about 31,000 applicants for university places, excluding Oxford and Cambridge, up to 2,500 who had the minimum entrance qualifications were unsuccessful in obtaining places.

One of the reasons given for this is a lack of candidates in certain subjects. Although in this case no indication is given as to whether or not it is lack of students of technology which is responsible for the places left vacant, it has certainly been reported elsewhere in recent years that university places earmarked for science students generally coming up from the schools have not been filled by suitable candidates. It seems that the greatest pressure of the industry in righting matters should be directed towards the provision of more science teachers and a higher standard of science teaching in the schools.

PROFITABLE TROLLEY-BUSES

Wolverhampton provides evidence that trolley-buses are still worth while in urban areas. The report for 1956-57 of Mr. R. H. Addlesee, the general manager, shows that while the county borough's 153 trolley-buses made a working surplus of £145,890 the 134 motor-buses operated at a loss of £17,508, although the average fare charged per mile was 1·493d against 1·549d.

Because the loan charges for each class of vehicle are not separately shown in the net revenue account it is not possible to judge from the report how these charges are apportioned but it is stated in an appendix that the ratio of total expenses (including capital charges) to total revenue is 91·09 per cent in the case of the trolley-buses and 112·23 per cent for the motor-buses. These results are not due to the Suez trouble because in 1955-56 the respective ratios were 97·2 and 117 per cent.

POWER STATIONS OF 1956

HAMS HALL "C"

PROGRESS IN CONSTRUCTION OF 360 MW PLANT

CONSTRUCTION of the 360 MW Hams Hall "C" generating station is now well advanced and the first two of the ultimate six 60 MW turbo-alternator/boiler units have been commissioned. The site lies about nine miles north-east of the centre of Birmingham and an area of 1,000 acres is occupied by the "A," "B" and "C" stations. It was originally purchased by the City of Birmingham Electric Supply Department in 1919 in anticipation of the growing electrical demand and when the "C" station has been completed the total generating capacity of the group will be 930 MW. Adequate road and rail facilities are available for fuel deliveries and the River Tame, which borders the site, provides the necessary supplies of cooling water.

The six turbines operate with steam conditions at the stop valve of 900 lb/sq in and 900 deg F and they are arranged in line in the turbine house which is flanked on one side by auxiliary switchgear and on the other by combined turbine and boiler operating panels and six 550,000 lb/hr boilers. Each boiler and turbine is designed for operation on a unit basis without interconnection with other units. Behind each boiler is its mechanical dust collector and electrostatic flue gas cleaning plant. The coal bunkers are arranged in a bay between the boilers and the operating panels, this position permitting a very simple arrangement of conveyor belts. The plant layout is symmetrical about a transverse centre line.

The turbine house is joined on the switchgear side by an administrative block which also accommodates the control room at operating floor level. Workshops and stores are situated behind the precipitator bay between the two brick chimney stacks, which are 400ft high. Adjacent to the administrative block and in a line parallel with the main building are three 350ft high, 4,800,000 gal/hr maximum capacity, reinforced concrete cooling towers which are believed to be the largest of their kind so far built anywhere in the world. The overall lengths of the turbine house and boiler house are 742ft 6in and 577ft 6in respectively, while the width of the main buildings, excluding the administrative block and the workshop and stores, is 337ft 9in. Altogether, the buildings cover an area of just under six acres.

The buildings are of conventional brick-clad construction, but to economise in the use of structural steel only the boiler house, bunker bay and workshops bay are steel framed, the total weight of structural steel being only 6,700 tons. The turbine house, administrative block and induced draught fan bay are of reinforced concrete construction. The total cost of the station is estimated at £21 million, one-third of which represents the cost of steam raising plant, compared with one-quarter for civil engineering work. Considerable economies have been effected in the civil engineering design and the total volume of the main buildings represents 41·5 cu ft/kW at a total cost of £4,800,000.

Coal Handling Plant

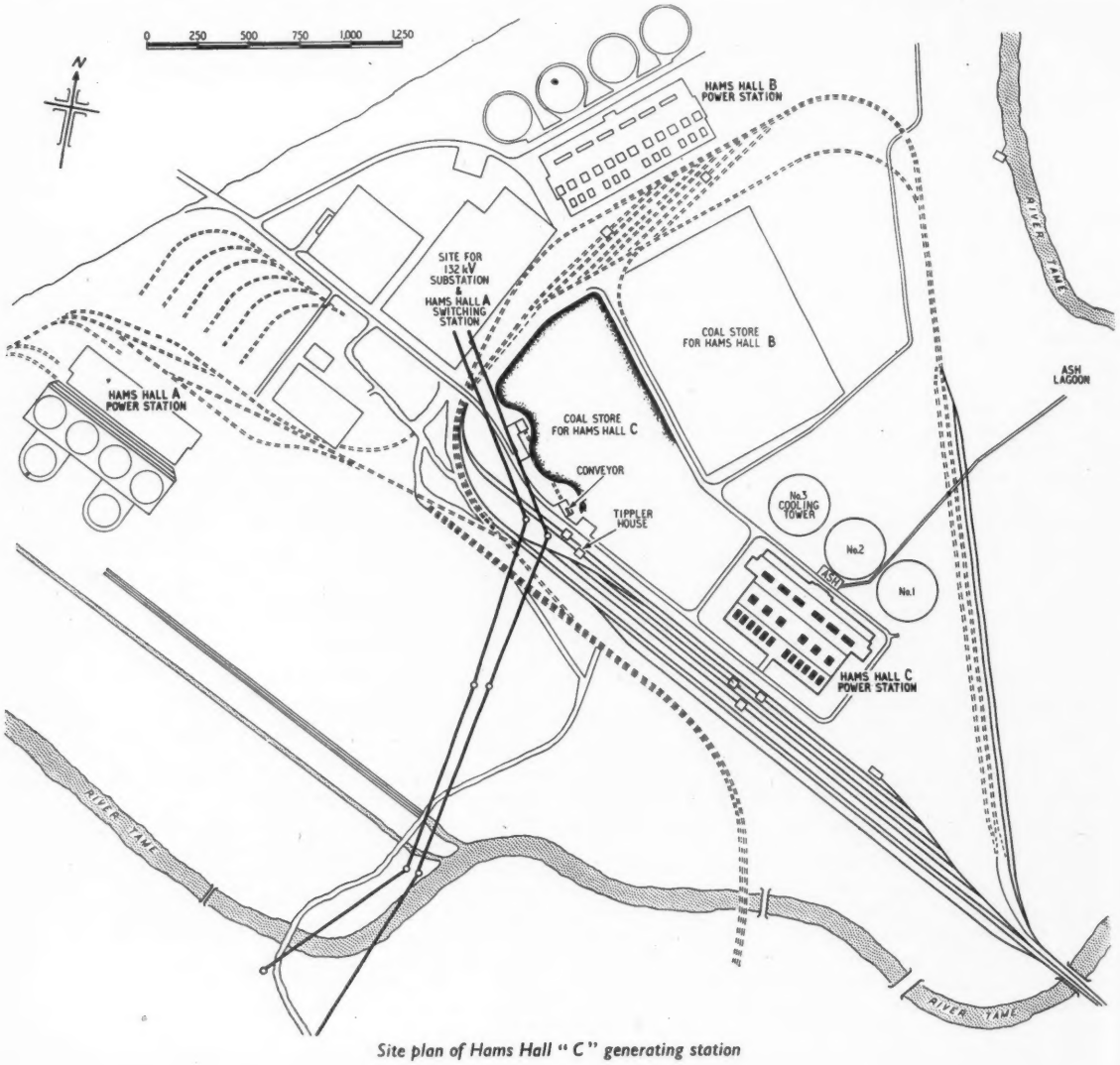
As already mentioned, coal is delivered to the station by road and rail. The handling system consists of 14 belts and five wagon tipplers, all supplied by the Mitchell Engineering Co., Ltd. Coal can be delivered direct to the boiler bunkers at a maximum rate of 850 tons/hr, or at a rate of 400 tons/hr when reclaiming from the 200,000 tons capacity storage area. The tipplers are of the single cam side discharge type, each with its own automatic weighing machine. Both road- and rail-borne coal is discharged through grids into bunkers feeding the belt conveyor system. The boiler bunker system is unusual in that it is a single structure of catenary cross-section, which is divided into six sections, each of 1,000 tons capacity. Each bunker section is associated with one boiler and coal is fed through four twin-feed chutes to four Type LM 16 "Lopulco" pulverising mills

manufactured by International Combustion, Ltd. The twin chutes pass through the operating floor to a hopper; single chutes then carry the fuel to a bell-mouthed feeder chute and on to the mill feeder table. Automatic coal weighers can be fitted in place of the twin chutes for test purposes.

Each mill has a capacity of 13·65 tons/hr when dealing with coal having a moisture content of 18 per cent and is driven through reduction gearing by a 185 b.h.p. 1,420 r.p.m. 3·3 kV Laurence Scott induction motor. Provided the moisture content of the coal does not exceed 18 per cent only three of the four mills installed are required for steaming the boiler at its maximum continuous rating. A table and plough type feeder is associated with each mill and this is driven by a 0·28/2 b.h.p. 314/2,200 r.p.m. variable speed motor. Each mill exhauster fan is of the paddle blade type and is driven by a 70/250 h.p. 960/1,470 r.p.m. 3·3 kV variable speed Laurence Scott motor which is regulated from the unit control panel.

The exhauster fans draw the pulverised fuel/air mixture from the mills via the separator and deliver it to the 16 burners which are situated in banks of four at each corner of the boiler. The burners are arranged to provide tangential firing and so produce a high degree of turbulence inside the combustion chamber. They can also be tilted 30 deg above and below the horizontal for automatic control of the final steam temperature. For lighting up, pressure raising, light load carrying and boost firing an automatic oil-fired system has been provided. This is equipped with six withdrawable type front wall burners arranged for automatic ignition, mechanical atomisers and a separate motor driven f.d. fan for each burner.

After combustion has taken place the resultant ash is collected in the 40 tons capacity dry type hopper beneath the furnace of each boiler and is discharged into a sluiceway by means of a Babcock & Wilcox "Hydrojet" high-pressure water jet sluicing system. The dust is removed from the mechanical grit collector and electrostatic precipitator hoppers by Redler conveyors which discharge into a sluiceway where it is carried away by water to the ash sump by gravity flow at the rate of 2,200 gal/min. Two high-pressure sluicing pumps (one acts as standby) of 1,500 gal/min capacity delivering at a head of 275ft are provided to supply water to the ash hoppers and sluice



Site plan of Hams Hall "C" generating station

nozzles, while duplicate ash crushers crush the ash before it joins the dust/water mixture in the gravity sluice to the ash sump.

Three pumps are provided to convey the ash through a pipeline to the settlement lagoons, but under normal conditions only one of them will be used; each has a capacity of 4,000 gal/min with a total discharge head of 110ft. Two 100 per cent duty sealing water pumps provide sealing water to the glands of the ash pump. The ash sump is supplied with make-up water from the circulating water main through a 12in thrustor operated equilibrium valve which is controlled by the sump water level. When ashing is not being carried out one ash pump is set for automatic operation to deal with the drain water which enters the sump from the sluiceways. The pump is arranged to start up and shut down according to the level of water in the sump.

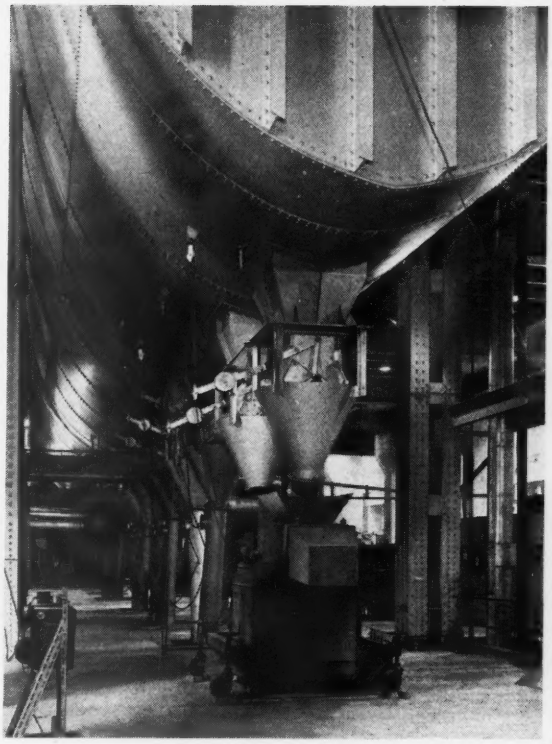
Steam Raising Plant

The completed station will accommodate six two-drum boilers manufactured by Simon-Carves, Ltd. They are of the radiant high-head design and have a maximum continuous evaporative capacity of 550,000 lb/hr, the pressure and temperature of the steam at the superheater outlet being 950 lb/sq in and 925 deg F. The combustion chamber is completely water cooled by 3in o.d. bare tubes pitched at 3¼in. Four pulverised fuel burners are accommodated in each corner of the chamber. The primary and secondary " Melesco " superheaters are self-draining. The primary superheater has two stages and is composed of multi-loop contra-flow elements, while the secondary superheater is of multi-loop horizontal parallel-flow elements. Twin spray type desuperheaters are provided between the two superheaters for further control of steam temperature should this be necessary at any time.

The horizontal type primary superheater headers are supported by sling rods from the boiler steelwork and in turn carry the weight of the superheater tubes. The secondary superheater connecting tubes are bifurcated to act as supports for the secondary superheater, the unit, as a whole, being supported by sling rods from the boiler structure, which is arranged so that all expansion takes place vertically downwards. Each unit is equipped with two Howden-Ljungstrom rotary regenerative air preheaters, a Davidson multi-cellular and cyclonic grit arrestor, and Simon-Carves electrostatic precipitators.

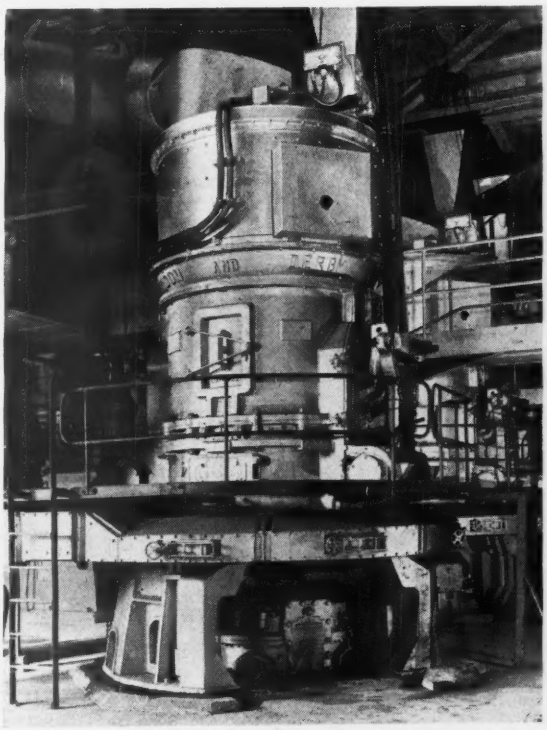
Each boiler is equipped with one direct-mounted water gauge and three remote water level indicators, two of which, the Igema and the Dewrange-Yarway, are mounted on the unit panel. The feed water is regulated by a Cope's " Flowmatic " system, which is responsive to both boiler water level and steam flow. The boiler water level element consists of a thermostat tube expanding and contracting with variations in water level. The " Flowmatic " controller consists of a spring-loaded diaphragm acted upon by the pressure differential across the superheater, thus giving response proportional to steam flow. The movements of each element, thermostat and controller are added together algebraically by means of a connecting chain link which transmits the resultant motion to a regulating valve in the feed supply line.

Water for boiler make-up is supplied by live steam evaporating plant installed by Aiton & Co., Ltd. Town water is softened in a base exchange plant supplied by the Permutit Co., Ltd., which comprises two units, each capable of softening at the rate of 6,000 gal/hr. The softened water is stored in tanks feeding the six triple-effect live steam evaporators, each of which has a net capacity of 25,000 lb/hr. The live steam consumption is



The boiler bunker system is a single structure of catenary cross-section

Each boiler is served by four type LM16 " Lopulco " pulverising mills



3,340 lb/hr at 900 lb/sq in giving a ratio of water gained to live steam of 7·5:1.

Steam temperature is controlled by means of corner firing tilting burners and spray type desuperheaters. The burners are tilted by Kent automatic air-operated control equipment which will maintain full control of steam temperature between 80 and 100 per cent of designed maximum steam output. The spray desuperheaters are intended for use as a setting control to cater for changes in cleanliness of the heating surfaces, abnormal operating conditions, etc.

The air heater equipment for each boiler comprises two 1¼ r.p.m. Howden-Ljungstrom rotary air heaters, each having a total heating surface of 77,800 sq ft. The design temperatures for air to and from the heaters are 90 deg F and 550 deg F respectively, and for gas leaving the heater 280 deg F, at maximum continuous rating.

Draught Plant

Each boiler is equipped with two forced and two induced draught fans of Davidson manufacture. Each f.d. fan is driven by a Laurence Scott 191/7 h.p. 1,050/325 r.p.m. variable-speed a.c. commutator motor through a Wellman Bibby coupling. The fan rotors are of the standard backward bladed design and at maximum speed deliver air at the rate of 89,000 cu ft/min. The i.d. fans are of the double inlet type and each is driven through a Wellman Bibby coupling by a 420/8 h.p. 950/235 r.p.m. Laurence Scott variable-speed a.c. commutator motor. At maximum speed each fan is capable of dealing with 155,000 cu ft/min of gas at 280 deg F.

For each boiler there are thirty electrically-operated Ivor Power soot blowers arranged to give sequence and/or selective operation from the unit control panel. Twelve gun type and two long retractable pattern blowers are provided for the furnace, while 16 long retractable blowers serve the superheaters. The steam is supplied from the desuperheater inlet pipe at 925 lb/sq in and 850 deg F. The electrostatic precipitation plant is being supplied by Simon-Carves, Ltd., and consists of two reinforced concrete units per boiler, each of which is fed with high-voltage d.c. from three static selenium rectifier units, which may be controlled locally or from the unit panel.

The boilers are equipped with the Bailey automatic control system the object of which is to ensure that sufficient steam is available at the turbine stop valve for the load on the turbo-alternator at any given instant, at the same time maintaining efficient combustion in the boiler. The operating medium is compressed air supplied from three 30 b.h.p. Broom & Wade compressors working at 90 to 100 lb/sq in.

A master controller measures the steam pressure at the turbine stop valve, compares it with the desired value and sends out an air loading pressure proportional to the difference between the desired and actual values. This signal, which takes the form of an alteration in air pressure from the normal standard, is passed through a master selector valve which enables the operator to allow the master pressure controller to control the boiler or, alternatively, to put the boiler on hand control. The outgoing pressure of the master selector valve is then transmitted to two groups of boiler auxiliaries, namely, mill groups to increase the fuel supply and f.d. fans to increase the air supply. Under normal operating conditions three mill groups are in service at maximum output. The coal feeder and exhauster motor speeds are controlled by induction regulators as also are the f.d. and i.d. fan speeds.

The six Fraser & Chalmers-G.E.C. turbines are designed to operate with steam conditions before the turbine stop valve of 900 lb/sq in and 900 deg F and to have an output of 60 MW at both maximum and economical continuous rating. They are of the two-cylinder impulse-reaction type and run at a normal speed of 3,000 r.p.m. Steam is bled for five stages of feed heating giving a designed final feed temperature of 385 deg F. At a load of 60 MW and an absolute back pressure of 1·3in Hg the specified steam and heat consumptions are 8·471 lb/kWh and 9,236 B.Th.U/kWh.

The cylinders are arranged in line. The machine is anchored between the h.p. and l.p. cylinders. The thrust forces due to reaction from the h.p. rotors are partly dealt with by the balance piston, while the remaining thrust, always in one direction, is held by the single Michell thrust bearing. This bearing also serves to locate the rotors in the casing and is adjusted by varying the thickness of the liners. The l.p. rotor, which is solidly coupled to the h.p. rotor, is in axial balance by virtue of the double steam flow to the exhaust. The main bearing adjacent to the thrust bearing is arranged with a safety collar and in an emergency will act as a thrust bearing while the set is slowing down. The thrust-failure tripping device ensures that under these conditions the steam is shut off.

Governing is by pure throttling through four symmetrically arranged valves housed inside the h.p. cylinder outer casing, there being no separate steam chest. With this arrangement the temperature distribution is practically constant throughout the h.p. casing at all loads and the machine is therefore suited to comparatively rapid load fluctuations. Two casings are adequate to accommodate the necessary stages for efficient utilisation of the heat drop and the very large exhaust blading area ensures low steam leaving losses.

Lubrication System

Two separate oil coolers, each of 100 per cent duty, are provided for each machine. The main centrifugal type oil pump, which is driven from the h.p. turbine shaft and assisted by a suction booster ejector, supplies two separate systems, " lubricating " and " power " oil, when the turbine is running at speed. A motor-driven auxiliary pump is used during running up, emergencies and shutting-down periods and operates in parallel with the main oil pump. The auxiliary oil pump is started automatically in the event of failure of the main oil pump. In addition, a d.c. motor-driven emergency oil pump starts up automatically in the event of failure of both the main and auxiliary oil pump. This supplies oil to the bearings only. In addition, an a.c. flushing pump and a jacking pump are provided.

The " power " oil supply divides into two branches after passing the runaway trip plunger. One branch supplies pilot oil which transmits movements of the centrifugal governor to the steam governor valve oil relays, while the other branch supplies power oil as the operating medium for the governor and runaway stop valves. Operation of the runaway trip plunger allows the whole power oil system to discharge back to the main oil tank and shuts off further supply of oil. Oil pressure is thereby released from the runaway and governor valves and the valves close under the action of strong springs and shut off the supply of steam to the turbine.

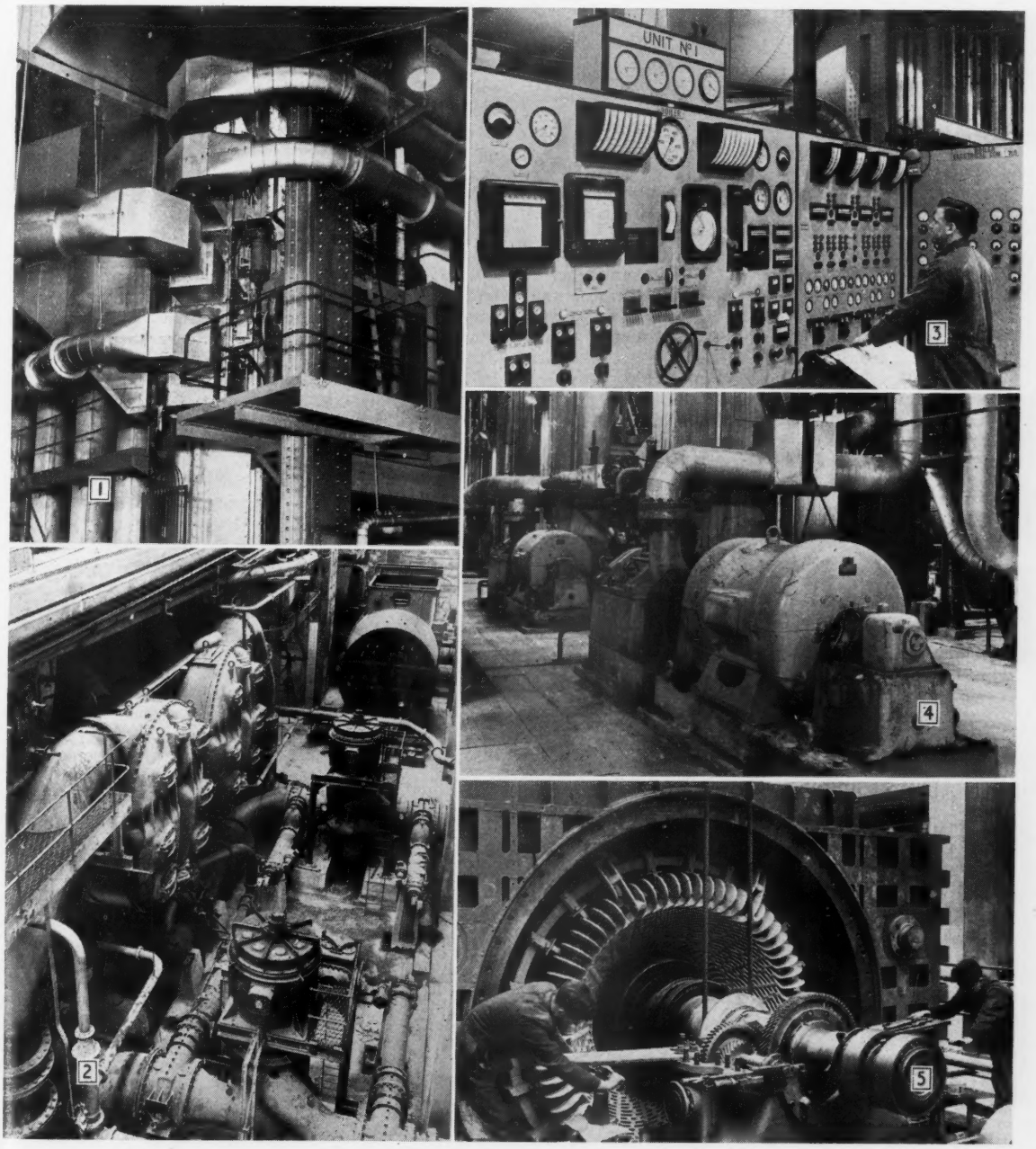
Each machine is equipped with a centrifugal type governor which is mounted on a cross shaft at the h.p. end and driven by a worm and worm-wheel from the main turbine shaft. There are two duplicate emergency valves of the double-beat type, each of which supplies steam to two of the four throttle valves. These emergency valves

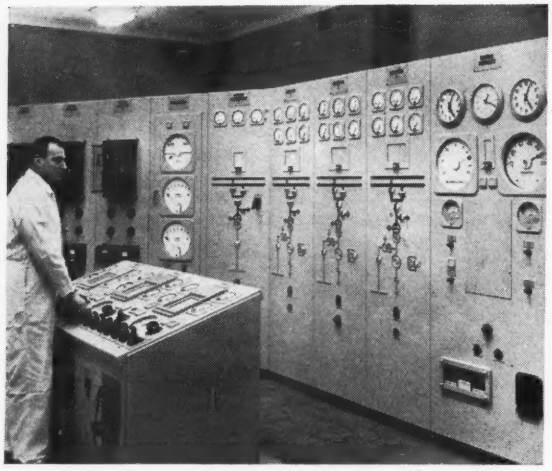
are also under control of the governor and they work in series with the throttle valves. The governing is improved by this introduction of double throttling effect and freedom of the valve to close in an emergency is ensured. There are a number of devices fitted to the machine such as the vacuum unloading device which starts to unload the machine if the vacuum falls to 26in Hg, and the low boiler pressure unloading device which relieves the machine if the boiler pressure falls to about 80 per cent of normal. Standard supervisory gear is also provided.

Each boiler and turbo-alternator is arranged to work on the unit principle and control panels for this purpose are situated between the boiler and the machine. Bailey control equipment is installed to maintain the output of the unit in conjunction with the control of the coal feed to the pulverising mills. All main dampers are controlled by Bailey pneumatic or Lockheed hydraulic equipment, while secondary air dampers are manually operated.

There are two Worthington-Simpson three-stage air ejectors and one quick-start air ejector for each turbine. The three-stage ejectors are condensate cooled and each

1. There are four p.f. burners in each corner of the boilers. 2. Condensers and main c.w. pumps for No. 1 turbo-alternator. 3. No. 1 unit control panel. 4. Two 100 per cent duty feed pumps are provided for each set. 5. Inserting the rotor into No. 3 alternator





Part of the main electrical control room

uses steam at the rate of 1,200 lb/hr, while the quick-start ejector is fed from the main steam supply at 2,800 lb/hr and discharges directly into the atmospheric pipe.

The double-flow l.p. turbine exhausts into two Worthington-Simpson condensers of the surface type, each of which has three passes, and together have a total cooling surface of 52,000 sq ft and a normal cooling water requirement of 33,000 gal/min at 63·5 deg F when operating with a vacuum of 1·3in Hg. Two 100 per cent duty three-stage horizontal extraction pumps, each with a normal capacity of 680 gal/min at a discharge pressure of 160 lb/sq in, are driven by 185 b.h.p. 3·3 kV Laurence Scott induction motors at 975 r.p.m. The output from these pumps is governed by the water level in the condenser hot well by the operation of a float-controlled valve in the common discharge line from the pumps.

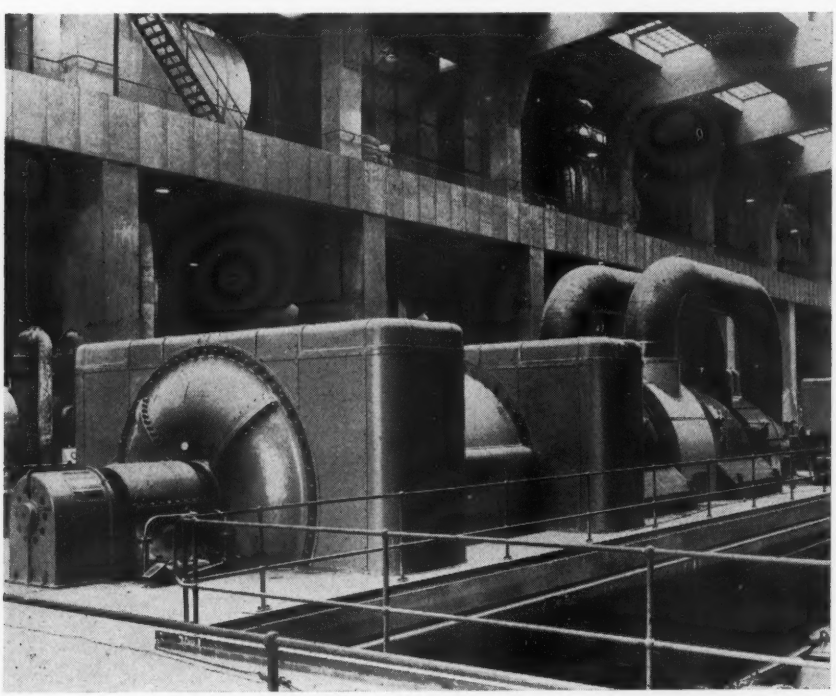
The feed heating train consists of four surface heaters, one direct contact high-level de-aerator heater, a drain cooler and gland condenser, all supplied by Worthington-Simpson, Ltd. Condensate is pumped from the condenser at 87 deg F by either or both extraction pumps and is fed via the condensate float-operated control valve, through main and/or standby air ejectors, drain cooler, l.p. heater No. 1, gland condenser, l.p. heater No. 2, vent condenser and preheater and then through nozzles of the de-aerator heater before entering the de-aerator storage tank. Two 100 per cent duty Weir feed pumps draw water from the de-aerator storage tank and discharge through Nos. 1 and 2 h.p. heaters, and via the main feed valve and a Cope's regulating valve to the boiler. The feed pumps are eight-stage centrifugal units discharging at a pressure of 1,315 lb/sq in at boiler m.c.r. and each is driven by a 3·3 kV 1,380 b.h.p. 3,000 r.p.m. Metropolitan-Vickers induction motor. Under normal conditions one pump acts as standby for the other and it is arranged to cut in automatically should the pressure in the discharge line fall by 150 lb/sq in.

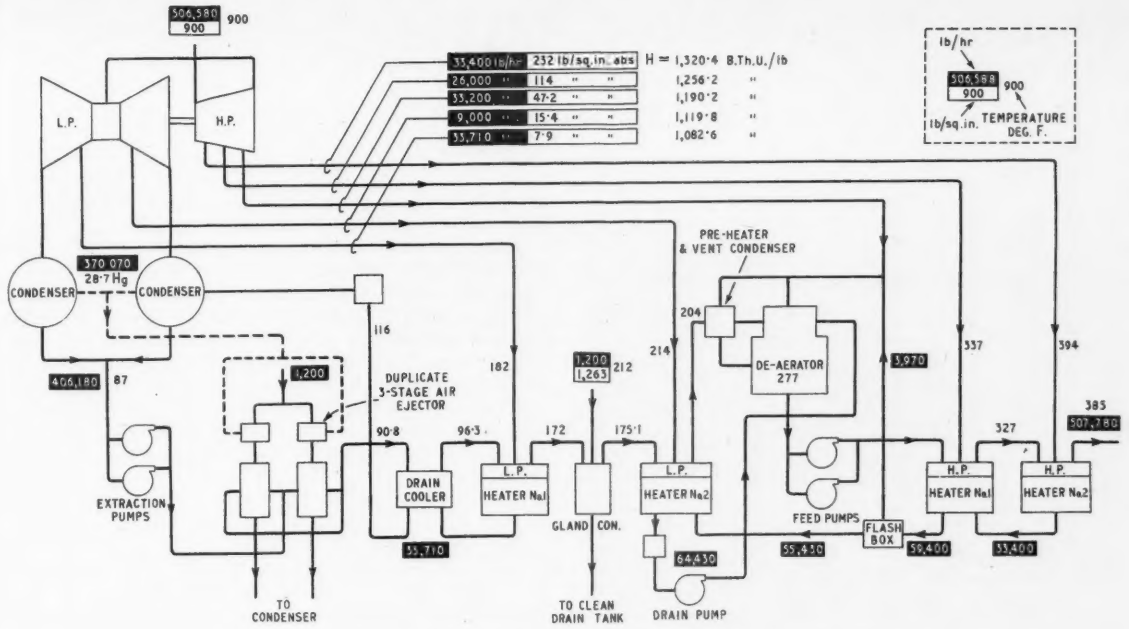
The circulating water for the condensers is cooled in three ferro-concrete towers designed by Film Cooling Towers, Ltd. The normal rating of each tower is 4,363,000 gal/hr through a cooling range of 18 deg F. The height of each tower is 350ft with an internal diameter of 242ft at the sill and 156ft at the top. Circulating water from the condensers is pumped to a height of 30ft through a central reinforced concrete stack to a circular discharge chamber. At this height the water is distributed over the area of the tower by means of timber channels to fall by gravity through porcelain outlets on to 3,450 glazed porcelain sprayer pots and then through the wooden lattice-work into the pond. This lattice-work represents an effective cooling surface of 1,635,000 sq ft.

Each cooling tower is divided so that half can be used when one turbo-alternator only is in operation. After cooling the water passes from either section of the pond into its own suction culvert. Cooling water for each turbo-alternator is pumped from the tower pond by two Mather & Platt vertical spindle c.w. pumps, driven by 485 b.h.p. motors, which are situated adjacent to the condensers in the turbine room basement. The pumps are designed to run in parallel and to deliver together 36,400 gal/min against a total head of 65ft. One pump has a capacity of 22,600 gal/min against a total head of 53ft.

The water to maintain the pond levels is obtained from the River Tame. It is screened by Deptford rotary strainers manufactured by Richardsons Westgarth & Co., Ltd., and is pumped to the ponds by four Worthington-Simpson vertical centrifugal pumps, each with a

The completed station will house six of these 60 MW turbo-alternator units





Heat balance diagram for 60 MW set at maximum and continuous economic rating

rating of 3,500 gal/min. This plant is housed in a building situated on the river bank and is remotely operated from the main control room. Circulating water treatment plant installed by Wallace & Tiernan, Ltd., is automatically controlled to inject chlorine solution into each condenser inlet for 15 min every four hours, the chlorine consumption being equivalent to 150 lb/hr continuously.

Electrical Connections

Each alternator generates at 11·8 kV when running at 3,000 r.p.m. and with a hydrogen pressure of 0·5 lb/sq in is rated at 60 MW at 0·8 power factor. The output voltage of each machine is stepped up by a G.E.C. 72 MVA, 11·8/141·6 kV generator transformer of the forced oil/air-blast type, the six similar units being arranged in outdoor cells along the length of the turbine house. On-load tap-changing equipment is fitted to give a voltage variation of ±10 per cent of nominal. Connection to the grid is made at 132 kV through Reyrolle air-blast switchgear with a normal current rating of 600 A and a three-phase breaking capacity of 3,500 MVA. Excitation of the alternators is a little unusual in that it is provided by a separate motor-driven d.c. generator, the main field of which is supplied from a pilot exciter mounted on the same shaft. Metropolitan-Vickers automatic voltage regulators of the quiescent type are incorporated in the excitation circuits.

A 6 MVA unit transformer, supplied by the Electric Construction Co., Ltd., is directly connected to each alternator and it feeds a 3·3 kV Reyrolle air-break switchboard which supplies the essential auxiliaries required for the operation of each unit. All other station supplies are obtained from two G.E.C. 10 MVA 132/3·45 kV transformers arranged for natural cooling. Four 750 kVA Bryce transformers step down from 3·3 kV to 415 V and feed Reyrolle air-break switchgear and English Electric switch-fuse gear, together with B.T.H. 415 V contactor gear supplying general auxiliaries and motors of less than 150 h.p.

Switching operations and alternator load adjustments are carried out from the main control room in the administration block. Two separate three-unit Reyrolle main generator control desks are installed in front of the Reyrolle generator central alarm and synchronising panels. On the opposite side of the control room a B.T.H. river water make-up control panel is fitted in front of the 3·3 kV Reyrolle works supply control panels, the latter forming a semi-circular board. Prevailing 3·3 kV circuit conditions are indicated on a mimic diagram and appropriate metering indication and control is provided. Main generator and transformer protection and metering panels, manufactured by Reyrolle and G.E.C. respectively, are provided in line with one another at the rear of the main generator control panels. Other equipment includes an English Electric local lighting and heating switch-fuse-board and a Lancashire Dynamo Switchgear, Ltd., d.c. control board incorporating battery control, operation and emergency distribution boards. Two Nife station batteries of 60 and 275 Ah capacities, together with their associated rectifying equipment, supply energy for these boards.

Construction of Hams Hall "C" is being undertaken by the Midlands Division of the Central Electricity Authority in conjunction with L. G. Mouchel & Partners acting as consultants for the civil engineering works, main buildings and superstructure. The main contractors are: civil engineering works, Sir Robert McAlpine & Sons (Midlands), Ltd.; structural steelwork, Braithwaite & Co. (Structural), Ltd.; main buildings and superstructure, Staverton Builders, Ltd.; chimneys and main flues, D. Theaker & Co., Ltd.; boilers, Simon-Carves, Ltd.; coal handling plant, Mitchell Engineering, Ltd.; ash handling plant, Babcock & Wilcox, Ltd.; turbo-alternators, General Electric Co., Ltd.

Acknowledgment is due to Mr. R. L. Batley, Divisional Controller, Midlands Division, Central Electricity Authority, for permission to publish this article, and to Mr. E. H. Cook, superintendent of Hams Hall "C," and the construction department of the Midlands Division, for invaluable assistance in the preparation of the material.

Water-Tube Boiler Research

CLOSE CO-OPERATION BETWEEN INDUSTRY AND UNIVERSITY

The test circuit at Cambridge, showing (on the left) the test section in the vertical position. On the right is part of the brick-built control room

A MAJOR research project, relating to the fundamentals of circulation theory in connection with high-pressure boilers and other types of evaporative heat exchangers, is being sponsored by the Water-Tube Boilermakers' Association and carried out by the Cambridge University Department of Engineering. The primary object is to establish experimental data relating to the pressure drop and flow conditions of a steam-water mixture flowing along heated and unheated pipes at pressures up to the critical. Little information on this subject is available but it is a field of increasing importance, particularly in the design of high-pressure boilers for power stations and of heat exchangers for nuclear plant.

The matter arose in 1950 when the attention of the Association was drawn to experimental work being undertaken at Cambridge. This work, started the previous year, was confined to a simple U-circuit at atmospheric pressure, without steam production in the riser, and was related to some theoretical studies which were being made on the rate of circulation in a simple boiler circuit. These studies resulted in a unification of the existing, but previously conflicting, theories on the subject known as the "hydraulic," "thermodynamic" and "expansion" theories of circulation.

This theoretical analysis was published in a paper entitled "Research into the Fundamentals of Boiler Circulation Theory," by R. W. Haywood, presented at a general discussion on heat transfer, organised jointly in 1951 by the Institution of Mechanical Engineers and the American Society of Mechanical Engineers. The paper was deliberately confined to a study of circulation theories which were based on the assumption that the steam-water mixture moved as a homogeneous fluid, because there existed a number of conflicting theories all of which took this assumption as their starting point. The purpose of the paper was to show how these differences could be resolved. The assumption is known to be questionable, but its cause is usually justified by the resulting simplification in a theoretical approach to the problem of circulation.

In conclusion the paper drew attention to the limitations of the experimental work undertaken at Cambridge, in that, in the absence of steam production, it was not possible to study the effect of relative velocity between the steam and water phases of a steam-water mixture. This phenomenon, commonly called "bubble slip," is known to exist under actual flow conditions in a boiler circuit. It was consequently indicated that there was a need to establish experimentally further data relating to pressure drop, and to the conditions of steam production, at the pressures employed in industrial plant.

Following a report from technical representatives of member companies of the Association, who visited the Engineering Laboratories to study the work, and after consultation with Professor J. F. Baker, head of the Department of Engineering at Cambridge, the Association agreed to sponsor an experimental research project proposed by the University as an extension of the existing work. A research contract was accordingly entered into with the University in 1951. Most of the available data on this subject has been obtained at pressures of less than 100 lb/sq in, but the Association-sponsored project, essentially fundamental in conception, is expected to provide much-needed data over a wide range of pressure levels.

Under the terms of the research contract it was agreed that the Association should provide the high-pressure drum and pipework, together with their structural supports, and this equipment was supplied, delivered and erected by one of the member companies. A technical advisory panel, consisting of representatives of the Department of Engineering and of the member companies of the Association, was formed to advise on practical and technical problems arising during the development stages and to plan the scope of the proposed test programme. The project falls, however, under the general supervision of Professor W. R. Hawthorne, Professor of Applied Thermodynamics, and is directed by Mr. R. W. Haywood, Lecturer in the Department of Engineering.

Early in 1952 the University acquired the site of a disused aircraft factory on the outskirts of Cambridge, and a portion of the site was allocated to the present research. The main advantage of this site is that the safety factor was greatly increased by the erection of the test circuit in the open air. Adequate electrical power supplies at standard voltage are readily available from an adjacent substation and the plant is operated by remote control from a brick-built control room.

The test section is 24ft long, but the heaters have been

designed to permit heating over 8, 16 or 24ft as desired. By this means the pressure drop in the unheated pipe following the heated part of the test section can be measured at selected inclinations. Water in the saturated condition from a steam drum flows through an " Electromersible " high-pressure circulating pump in a continuously recirculating closed system. The rate of circulation is measured by a standard orifice assembly, and is regulated and maintained constant by adjustment of a control valve. An electrical " Pyrobar " immersion-type preheater is used to ensure that the fluid enters the inlet of the heated test section at exactly the saturation temperature corresponding to its pressure at that point, thereby offsetting heat losses in the pump and connecting pipework and the effect of pressure difference between the test section inlet and the steam drum.

Accuracy is achieved by measuring carefully the differential pressure between the test section inlet and the drum, and then adjusting the differential temperature—which is measured directly by accurately calibrated thermocouples of high sensitivity—to correspond to this pressure difference. Consequently, steam generation commences exactly at the inlet and takes place along the entire heated length of the test section. When desired, only the first 8 or 16ft of the section need be heated, so that both evaporating and non-evaporating conditions can be investigated.

To the test section outlet there is connected a 1ft length of alloy steel tube, the contents of which are scanned by a gamma-ray beam from a small capsule containing a radioactive isotope of caesium. The use of the high-tensile steel alloy enables more sensitive readings to be obtained from the gamma-ray device by reducing the wall thickness of the pipe and thereby its screening effect. An ionisation chamber at the opposite end of the diametral axis acts as a receiver, and measures the emergent radiation which is a function of the density of the contents of the pipe. This equipment, which is on loan from the Atomic Energy Research Establishment, Harwell, enables an estimate to be made of the apparent density of the fluid mixture leaving the test section, and consequently the respective velocities of the two phases at that point. It should be noted, however, that the velocities thus calculated are " average " values.

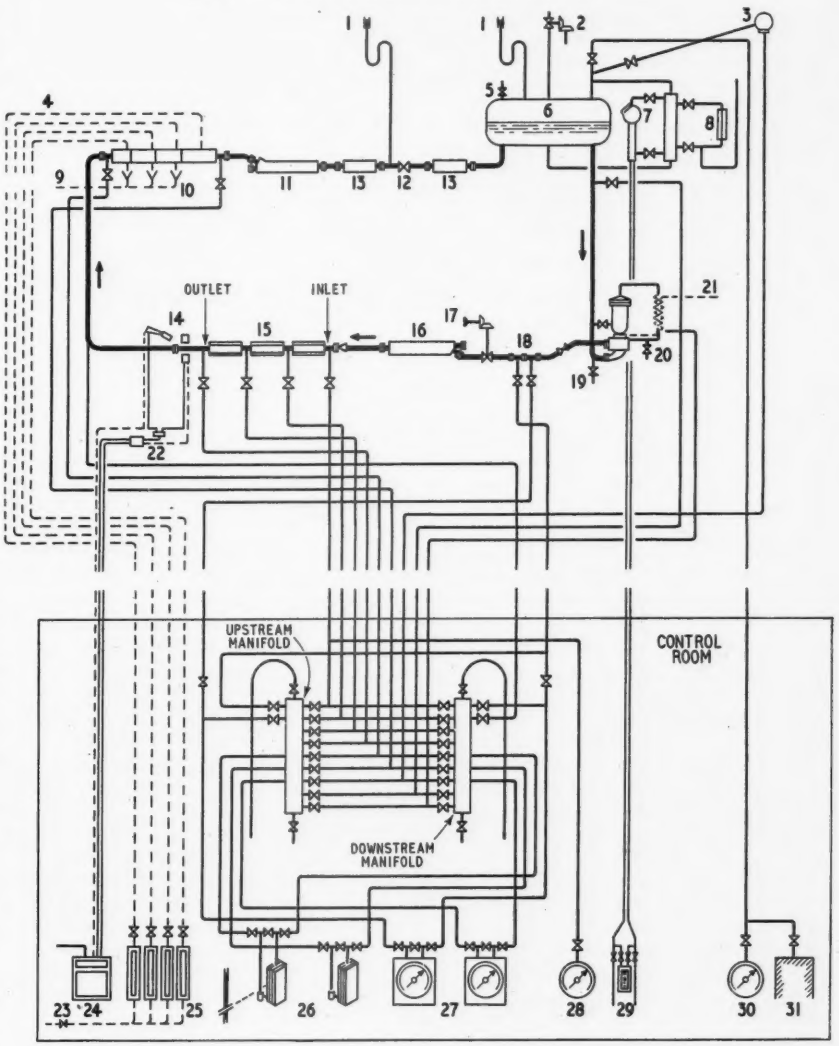
On leaving the test section the steam-water mixture enters a water-jacketed condenser and finally passes through an electrically-heated reheater before returning to the drum. Constancy of the operating pressure is maintained by combined adjustment of the quantity of condenser cooling water and the electrical input to the reheater.

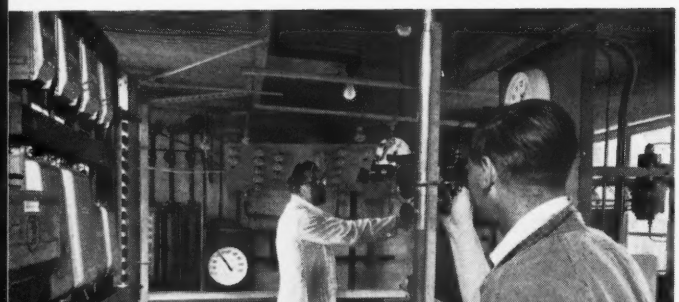
Complete automatic control of the circuit is not intended, and the initial tests have been regulated entirely by manual adjustment. Thermocouples are installed at various parts of the circuit. These will, if required, supply direct readings of temperature in the usual manner, but where temperature differences are more important the individual couples are connected in opposing pairs to give differential readings, thus saving time and also reducing the observational error in the readings. Thermocouples are also peened into the outer surface of the test-section tube wall in order that a check may be kept against the overheating of the tube.

Method of Heating

Various alternative methods of heating the test section electrically were considered, the main requirements being ease of control and uniform heat absorption per unit

Diagrammatic arrangement of the high-pressure test circuit





View of control room with operator taking a reading of differential pressures through a cathetometer

length of pipe. Low-frequency induction heating was finally adopted as it did not require electrically-insulated high-pressure joints and was adaptable to three-phase heating for increased heat inputs. It has proved admirably suited to the purpose.

Very little information was available on this type of low-frequency induction heating and much preliminary work, itself in the nature of a fundamental investigation, had to be done to establish what heat input rates were possible. The results of this investigation are expected to be of value in other applications, in addition to having a direct bearing on the present research. The heaters were designed and constructed in the Engineering Department of the University in consultation with Wild-Barfield, Ltd., who hold a patent on a certain feature of the water-cooled windings. The design finally adopted permits the power supplied to be varied over a considerable range in a number of steps without the use of an expensive voltage regulator.

Preliminary trials were carried out with a test section of 1in bore, 24ft long, mounted in the horizontal position. These were planned mainly to enable the operating staff to become familiar with the response of the respective controls, and to check the accuracy of the various measuring and recording instruments. A further series was subsequently conducted at four pressure levels, and the results were carefully analysed. Proposals were made for improving the operation of the experimental plant and these were accepted by members of the Technical Advisory Panel. It had been agreed earlier that the operating technique should be perfected with the test section in the horizontal position since the gravitational effects in a vertical pipe were expected to render the analysis more difficult.

The first full series of tests was then made on the 1in bore horizontal test section at five pressure levels, namely, 250, 600, 1,250, 2,100 and 3,000 lb/sq in. The results, together with those obtained from other tube sizes at various inclinations, will be published in due course.

Electricity Supply in Northern Ireland

ELECTRICITY BOARD'S ANNUAL REPORT

THE annual report of the Electricity Board for Northern Ireland for 1956 shows that sales of electricity increased over the previous year by 10·2 per cent to a total of 465·4 million kWh, and the average price obtained per kWh sold was 1·92d, as compared with 1·78d for 1955. An additional 8,652 consumers were connected during the year bringing the total to 152,882.

The total revenue for the year was £3,798,300, as compared with £3,183,612 for 1955, and expenditure totalled £2,970,846, leaving a balance of £827,454 (£712,211); after deducting interest, depreciation, etc., the surplus for the year is £326 (against £694). The Ministry of Commerce granted consent to the borrowing by the Board of further sums amounting to £5,391,465, bringing the total sanctioned to £21·6 million.

During the year approximately 548 miles of e.h.v. overhead lines were constructed, 11 miles were removed from service and three miles of e.h.v. cable were laid. By the end of the year the mileage of the Board's system was 209 miles of 110 kV, 1,306 miles of 33 kV, 2,567 miles of 11 kV and 123 miles of 6·6 kV, a total of 4,206 miles. L.v. mains and distributors added during the year amounted to 192 miles, making a total of 2,587 miles. Rural development schemes were approved during the year at a cost of £927,573, providing for supplies to 1,992 farms, 2,827 domestic premises and 231 other rural premises.

The increase in bank rate, credit restrictions and alterations in the terms of hire purchase made the business in sales of appliances difficult, and the total sales of £177,153 were 12·34 per cent lower than in the preceding year. The appliances sold represented a connected load of 22,516 kW.

The report refers to the White Paper on "Electricity Supply in Northern Ireland," in which a limited programme for the years immediately following 1960 are outlined. The main proposals in this programme are as follows:—

The Electricity Board should establish a new power station at Londonderry with an initial generating capacity of at least 60 MW, provided by two generators of 30 MW each; the boilers should be adapted for the use of oil fuel. The Board's h.v. transmission mains (110 kV) should be extended to Londonderry from both directions, that is, from Omagh and from Ballymena. An additional generator of 30 MW should, if necessary, be installed at the Ballylumford station.

Further proposals for plant extensions beyond 1962 are outlined, including the establishment by the Board in its area of supply of an atomic power station to come into operation in 1963-64, or later.

Before the end of the year contracts had been placed for the 110 kV lines and the 110 kV switchgear and transformers for the Omagh and Balllymena terminations of the lines and for two 30 MW turbo-alternators and two oil-fired boilers.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

The Minister of Power has appointed **Mr. C. T. Melling,** C.B.E., M.Sc.(Tech.), M.I.E.E., M.I.Mech.E., M.Inst.F., F.I.I.A., chairman of the Eastern Electricity Board, to be a member of the Central Electricity Authority until 31st December next, in place of the late Mr. L. Howles, C.B.E.

Mr. F. W. Skelcher, M.I.E.E., M.I.Mech.E., chief generation engineer (operation) of the Midlands Division of the Central Electricity Authority, has been appointed deputy chief engineer (generation and system operation) of the C.E.A.

Mr. F. W. Skelcher

Mr. Skelcher, who was a trainee with Chamberlain & Hookham, Ltd., and with the Birmingham Electric Supply Department, took up his first appointment with the department in 1928 as control room engineer at the Prince's power station. He remained with the Birmingham Corporation for twenty years, serving successively as boiler house shift engineer at the Nechells Prince's station, engineering clerk of works for the extensions at Hams Hall "A," assistant mechanical maintenance engineer for the four power stations of the Department, assistant power station superintendent of Hams Hall "B," and then superintendent of Hams Hall "B" until, finally, he became deputy generating stations engineer of the Department. On nationalisation in 1948 he was appointed generation engineer (operation) of the Southern group of power stations of the Midlands Division. Two years later he took up his present post.

Sir George Nelson, Bt., chairman of the English Electric Co., Ltd., is a member of the Civic Trust whose aim is to encourage good architecture and town planning. Industrial concerns are contributing to the funds of the Trust and have already ensured an income of £40,000 a year on seven-year covenants.

Mr. P. H. Jackson, M.C., has been appointed an assistant sales manager with the Lancashire Dynamo Group. He joined L.D.C. at Trafford Park in 1936 and, after war service, was appointed to the company's Manchester sales office. In 1951 he joined the London office staff where he has specialised in the supply of equipment to power industries. These appointments are part of the group's new selling arrangements which are operated through Lancashire Dynamo Group Sales, Ltd.

Mr. A. J. C. MacLeod, A.M.I.E.E., has been appointed export manager of the Lancashire Dynamo Group. Since 1951 he has been export manager of L.D.C., having joined the company in 1949. He served his apprenticeship with the Metropolitan-Vickers Electrical Co., Ltd., and remained with that company until 1945, subsequently joining the Electric Construction Co., Ltd.

Mr. E. Webster, B.Sc.(Eng.)(Hons.), A.M.I.E.E., development engineer in the Development Division, Department of the Chief Mechanical Engineer (Railways), London Transport, has been promoted to principal development assistant. He will report to the assistant mechanical engineer (development) (railways). Mr. Webster, who is forty-nine, entered the service of the London Passenger Transport Board in 1938 as a technical assistant with special knowledge of traction motor design and construction. He was appointed development engineer in 1951. From 1929 until 1938 he was with the Metropolitan-Vickers Electrical Co., Ltd., at Manchester and Sheffield.

Mr. V. H. C. Phillips, a director of Kent Bros. Electric Wire Co. & E. H. Phillips, Ltd., has been appointed assistant general manager of the company.

Mr. H. L. Jubber, deputy station superintendent, Brimsdown generating station, retires from the service of the Eastern Division of the Central Electricity Authority on 31st August after having completed thirty-four years' service in the industry. Mr. Jubber served a mechanical engineering apprenticeship and commenced in the industry as a shift charge engineer with the Northmet Power Co. He was appointed boiler house superintendent at Brimsdown generating station in 1948 and became deputy station superintendent in 1951.

Mr. W. Ewing, A.M.I.E.E., A.M.I.Mar.E., deputy station superintendent, Letchworth generating station, has been appointed deputy station superintendent at Brimsdown as from 1st September. He took up his present position at Letchworth in July last year, having previously been at Ironbridge generating stations with the Midlands Division as a boiler house shift charge engineer and shift charge engineer since 1949.

Mr. H. L. Jubber

Mr. W. Ewing

Mr. A. N. Baker

Mr. A. N. Baker, maintenance engineer (mechanical), Letchworth generating station, has been appointed deputy station superintendent, Letchworth, as from 1st September. Mr. Baker was first employed in the industry with the Bedford Corporation as a switchboard attendant in 1926 and has been at Letchworth generating station as a shift charge engineer since 1933. He was appointed to his present position of maintenance engineer (mechanical) in April last year.

Mr. F. B. Cope, B.Sc.(Eng.), A.M.I.E.E., has been elected hon. general secretary of the Association of Scientific Workers. He will be concerned largely with the science policy side of the Association's work, including fuel and power policy and science education. He is a member of the London Regional Advisory Committee for Higher Technological Education in Electrical Engineering, and of the Standing Committee of the University of London Convocation.

Mr. F. B. Cope

Mr. W. A. Hartop, works director of George Kent, Ltd., left London on Saturday last on the first stage of a round-world tour, the main object of which is to stimulate and expand the company's export markets.

On the evening of 28th June the **Lightmongers** held their summer meeting, and the Thames motor vessel *Queen Elizabeth* was specially chartered for the occasion. Over

On the Lightmongers' Thames trip: Messrs. Max Millar (past-president), Henry Hall (president) and Walter Veness (past president)

seventy members and their guests enjoyed a voyage down the River Thames, a running buffet was provided and there was dancing under an illuminated awning on the top deck.

Mr. H. Horton Smith, A.M.I.E.E., who jointly formed the firm of Abell & Smith's Electrical Co., Ltd., with the late Mr. C. E. Abell, in 1919, has relinquished his position as managing director as from 30th June. He is succeeded by **Mr. G. C. Tysoe,** B.Sc., A.M.I.E.E., who was appointed a director when Mr. Abell retired in 1936. Mr. H. Horton Smith will continue as chairman.

The Westinghouse Brake & Signal Co., Ltd., announces the following appointments to the board:—**Mr. G. W. H. Richardson, Mr. T. J. Aldridge** (manager, Signal & Colliery Division), **Mr. N. G. Cadman** (works manager), **Mr. J. W. G. Kershaw** (manager, Brake Division) and **Mr. L. E. Thompson** (manager, Rectifier Division).

Mr. W. Loat, sales supervisor of the Midland Electric Manufacturing Co., Ltd., has retired after thirty-eight years' service with the company. He commenced his electrical career with the Electric & Ordnance Accessories Co. and followed with a period on the works staff of George Ellison, Ltd. After service in the R.F.C. and R.A.F. during the 1914-18 war he joined the M.E.M. sales force and was the company's first representative in the Midlands. He was appointed sales supervisor for the whole of the British Isles in 1938.

Mr. G. Grove, formerly East Midlands representative, has been appointed London manager of the company. He received his initial training with the G.E.C. and joined the M.E.M. sales staff in 1935, being appointed to the East Midlands territory in 1936. He is a founder member and past-president of the Leicester Electric Society.

Mr. J. Roe has taken over the East Midlands territory from Mr. Grove. He joined the company nine years ago.

Mr. W. Loat

Mr. G. Grove

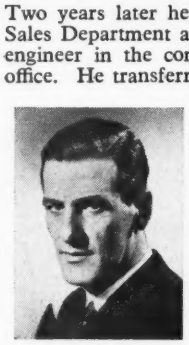
Mr. J. Roe

The Midlands Area final of the **Electrical Industries National Golf Championship** was held on 26th June, 1957, at Edgbaston Golf Club. There were eighty-one competitors, and the event was followed by a dinner, at which the principal guest was Mr. W. Lewis, chairman of the Midlands Electricity Board. The winners were as follows:—Railing Cup (first best net): Mr. A. E. Shinton. Jacob Cup (second best net): Mr. R. C. F. Atkins. First best gross: Mr. E. Walton.

Mr. Harold H. Saint, who was until recently chief sales engineer in the Electrical Division of the Expanded Metal Co., Ltd., has been appointed sales manager, Electrical Division, Fawcett Preston & Co., Ltd., Bromborough, Cheshire, one of the Metal Industries group of companies. Mr. Saint has taken over control of all sales, design and development work related to Fawcett Preston's industrial, marine and traction resistor production, these services having previously been provided by the Igranic Electric Co., Ltd. The departments concerned will be established from 1st August at Bromborough where full technical service will then be available. Before the war, Mr. Saint was for ten years with the Rheostatic Co., the original makers of the equipment with which he is now concerned.

Mr. H. H. Saint

Mr. C. W. Nixon, who writes in this issue on "Series Power Capacitors," is a regional manager in the Overseas Sales Organisation of British Insulated Callender's Cables, Ltd. On completion of his university course at Queen Mary College, London, he was commissioned into the R.N.V.R. as an electrical engineer. After the war, in 1946, he joined the Research Department of B.I.C.C. as an engineer. Two years later he joined the Home Sales Department and became a sales engineer in the company's Liverpool office. He transferred, in 1951, to the Overseas Technical Sales Department. His duties in these two departments were concerned mainly with the applications of power capacitors to industrial and supply systems.



Mr. C. W. Nixon

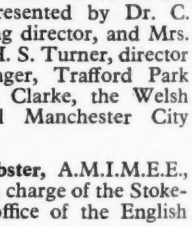
At the beginning of this year Mr. Nixon was appointed to the post of overseas regional manager and is now responsible for the co-ordination of B.I.C.C. interests in the West Indies and Latin America.

The annual sports and gala day of the **Metropolitan-Vickers Electrical Co., Ltd.,** was held on 22nd June at the apprentice training school ground adjacent to the Trafford Park Works, and was attended by approximately 10,000. Various of the athletic events were open to all A.E.I. companies, and among the prize-winners were competitors from M-V Works at Finchley, Motherwell and Wythenshawe. An added attraction was the appearance of Derek Ibbotson and a number of other well-known athletes who ran in the invitation 1-mile race.

A number of directors were present, and the Mayor and Mayoress of Stretford assisted in judging the "personality girl" contest. Prizes and trophies were presented by Dr. C. Dannatt, managing director, and Mrs. Dannatt, Mr. R. H. S. Turner, director and works manager, Trafford Park Works, and Roy Clarke, the Welsh international and Manchester City footballer.

Mr. G. S. Webster, A.M.I.M.E.E., has been placed in charge of the Stoke-upon-Trent sub-office of the English Electric Co., Ltd.

Mr. F. B. Richardson, M.I.E.E., managing director of M. & C. Switchgear, Ltd., retired on 28th June. On the eve of his retirement, Mr. Richardson was presented with a hand-made display cabinet from the employees of the company and Mrs. Richardson with a diamond pendant and jewel box.



Mr. F. B. Richardson

Mr. Richardson was born in Liverpool and was educated at St. Cuthbert's Grammar School and Rutherford and Armstrong Colleges, Newcastle-on-Tyne. After training with Clarke, Chapman & Co.

and a period with A. Reyrolle & Co. and the British Westinghouse Co., he joined Mavor & Coulson in 1908 and became chief draughtsman with M. & C. Switchgear, Ltd., in 1931. He was appointed managing director in 1937. Mr. Richardson is a fellow of the Association of Mining Electrical and Mechanical Engineers.

We are asked to state that **Mr. H. A. Luss** has been appointed chairman of the *Nucleonic* Group of the Scientific Instrument Manufacturers' Association and not of the Nuclear Group as reported in our last issue.

The Southern Areas Electric Corporation, Ltd., announces that **Mr. M. Marshall** has relinquished his appointment as general manager of its subsidiary, Resinoid & Mica Products, Ltd., to establish a service in the Midlands, especially to small firms, to advise in production and sales development.

Mr. W. A. Lishman, buyer for W. T. Henley's Telegraph Works Co., Ltd., recently completed fifty years' service with the company, and at a luncheon which followed this year's annual general meeting of the company, the chairman, Sir John Dalton, presented to Mr. Lishman a framed copy of a resolution of the board in appreciation of his services. Apart from his service in H.M. Forces during 1914-19, Mr. Lishman has spent the whole of his career in connection with the company's buying, and has been in charge of this part of the organisation since 1943.

Mr. W. A. Lishman

Mr. E. W. Jones, B.Sc., A.Inst.P., has been appointed sales manager of Isotope Developments, Ltd., Aldermaston. He has been with the company since 1950 and was formerly at the Atomic Energy Research Establishment, Harwell.

The annual "treasure hunt" organised by the **Exeter Electric Club** took place on 3rd July. The Peters Cup was won by Mr. R. Turpin and his crew, Mr. W. Hallam, the Club's president, was second and Mr. R. Madge third, this place being decided on the toss of a coin. The organisers, Mr. and Mrs. Warman, were thanked by Mr. W. Hallam, who presented Mrs. Warman with a gift in appreciation of their efforts.

Mr. E. G. Fielding, publicity manager of Vickers, Ltd., has been elected president of the Incorporated Advertising Managers' Association.

Last Tuesday's luncheon of the **Electrical Industries Club** was "ladies' day" and there was a good attendance. Mr. A. F. Plummer, the president, took the chair and Mr. A. B. Wildsmith proposed the health of the ladies. During the proceedings Mr. Plummer presented the Club golf cup to Mr. P. G. Wardle (Revo Electric Co.) and the runner-up prize to Mr. E. S. Evans (Ekco Ensign). The speaker was Miss Audrey Cameron of the B.B.C., who gave an amusing address. The vote of thanks to Miss Cameron was proposed by Mr. E. G. Batt. Mr. Plummer reminded members that there would be no August meeting; the next luncheon would take place on 10th September.

OBITUARY

Major W. I. Anderson died at his home on 2nd July. He joined the board of the Micanite & Insulators Co., Ltd., in 1932 and had been chairman since 1944. He was also managing director of Associated Insulation Products, Ltd., and a director of British Industrial Plastics, Ltd.

Viscount Cherwell, P.C., C.H., F.R.S., who died on 3rd July, was a part-time member of the United Kingdom Atomic Energy Authority. He was formerly Professor of Experimental Philosophy at Oxford and during the 1939-45 war was personal adviser to Mr. (now Sir) Winston Churchill.

WILLS

Mr. H. B. Jenkins, for forty years deputy borough electrical engineer at Bedford, who died on 4th July last, left £5,987 gross (£5,926 net).

Mr. H. C. Hastings, formerly chief of the Control Gear Design-Engineering Department of the British Thomson-Houston Co., Ltd., who died on 7th December last, left £11,348 gross (£11,275 net).

Mr. R. J. A. Hawker, director of John Thompson (Instrument) Co., Ltd., who died on 21st December last, intestate, left £3,332 gross (£2,947 net).

Mr. H. E. Drabble, radio and electrical engineer, and a member of the Electrical Contractors' Association, who died on 24th November last, left £20,616 gross (£18,537 net).

Mr. J. B. Lees, M.I.E.E., formerly district consumers' engineer at Salford to the North Western Electricity Board, who died on 30th January last, left £3,092 gross (£2,939 net).

Mr. H. B. Harvey, retired manager and engineer of Kent Electric Power Co., who died on 8th January last, left £7,130 gross (£6,864 net).

Mr. J. MacMahon, J.P., late a director of the Telephone Manufacturing Co., Ltd., and Telephone Rentals, Ltd., left personal estate in England and Scotland valued at £48,843.

Non-Destructive Testing

The Joint Committee on Materials and Their Testing of Technical Institutions and Societies in Great Britain announces the formation of the British National Committee for Non-destructive Testing. Applications for membership of the Committee are invited from interested institutions or societies. The subscription is 5 guineas per annum. Each member society will be asked to nominate a representative who would take part in meetings of the National Committee. Applications, for the time being, should be made to the secretary of the Joint Committee on Materials and Their Testing, Mr. R. Main, A.M.I.Mech.E., 1, Birdcage Walk, Westminster, London, S.W.1. Pending an election, the chairman of the British National Committee will be Mr. C. H. Stanger, A.M.I.C.E., A.I.Struct.E.

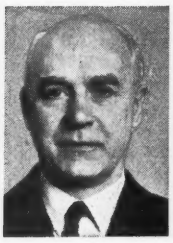
London Board Reorganisation

As we have already reported, the London Electricity Board is in process of reorganising its area to make it a "two-tier" structure. When the reorganisation is complete the area will be divided into the following districts:

District No.	Area Covered	Approved Name
1	Hampstead and Willesden	North Western
2	Hammersmith and Fulham	Western
3	Chelsea, Kensington and Paddington	West Bourne
4	St. Pancras and St. Marylebone	Regency
5	Holborn and Westminster	West End
6	Hackney, Islington and Stoke Newington	Northern
7	City, Finsbury and Shoreditch	Central
8	Bethnal Green, Poplar and Stepney	East End
9	Walthamstow and Leyton	North Eastern
10	Chigwell (part), Dagenham (part), Ilford, Wanstead and Woodford	Essex Suburban
11	Barking, East Ham and West Ham	Eastern
12	Barnes, Battersea and Wandsworth	South Western
13	Malden and Coombe, Merton and Morden, Mitcham, Wimbledon	Surrey Suburban
14	Camberwell and Lambeth	Southern
15	Bermondsey, Deptford and Southwark	Borough
16	Beckenham, Bromley, Lewisham and Penge	Ravensbourne
17	Greenwich and Woolwich	South Eastern
18	Bexley, Crayford, Dartford, Erith, Chislehurst and Sidcup (part)	Kent Suburban

Mr. T. E. Goldup

Dr. Willis Jackson


Mr. C. E. Melling

Dr. J. S. Forrest

Mr. F. C. McLean

Mr. B. L. Metcalf

I.E.E. ELECTIONS

New President, Council Members and Section Officers

The presidential chair of the Institution of Electrical Engineers will be occupied by Mr. T. E. Goldup, C.B.E., M.I.E.E., a director of Mullard, Ltd., for the 1957-58 session.

Mr. Goldup was an external student of London University and an assistant at the Royal Naval College, Greenwich. From 1914 to 1921 he was on the staff of the Experimental Department of the Signal School and H.M.S. *Vernon*. He joined the Mullard organisation in 1923 as assistant in the valve laboratory of the Mullard Radio Valve Co., becoming technical assistant to the works manager; in 1928 he was appointed head of the Technical Service Department. He was elected a director of Mullard Equipment, Ltd., in 1938, a director of the Mullard Radio Valve Co. in 1940 and a director of Mullard, Ltd., in 1951. Mr. Goldup was elected chairman of the Radio Communication and Electronic Engineering Association for 1953 and is chairman of the governors of the Ministry of Supply School of Electronics, Malvern. He serves on committees of the British Standards Institution and on the Radio Research Board, Department of Scientific and Industrial Research. He was chairman of the Wireless Section of the I.E.E. for 1943-44 and became a vice-president of the Institution in 1952.

Dr. J. R. Mortlock

Mr. C. E. Strong

To fill the two vacancies for vice-presidents, Mr. Willis Jackson, D.Sc., D.Phil., Dr.Sc.Tech., F.R.S., director of research and education, Metropolitan-Vickers Electrical Co., Ltd., and Mr. C. T. Melling, C.B.E., M.Sc.Tech., M.I.Mech.E., M.Inst.F., chairman of the Eastern Electricity Board, have been elected. Viscount Falmouth, part-time member of the South Eastern Electricity Board, has been re-elected hon. treasurer.

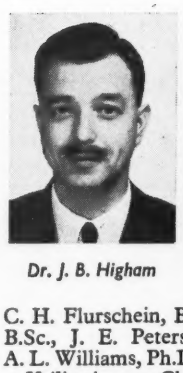
The five vacancies on the Council have been filled by the following: Mr. J. S. Forrest, D.Sc., M.A., F.Inst.P. (director of laboratories, Central Electricity Authority); Mr. F. C. McLean, C.B.E., B.Sc. (deputy chief engineer, B.B.C.); Mr. B. L. Metcalf, B.Sc., A.R.T.C., M.I.Mech.E., M.I.Min.E. (chief engineer, H.Q., National Coal Board); Mr. J. R. Mortlock, Ph.D., B.Sc.(Eng.), M.Am.I.E.E. (manager, Power System Engineering Department, British Thomson-Houston Co., Ltd.); and Mr. C. E. Strong, O.B.E., B.A., B.A.I., F.I.R.E. (chief radio engineer, Standard Telephones & Cables, Ltd.). Associate member: Mr. J. B. Higham, Ph.D., B.Sc. (lecturer in electrical engineering, Birmingham University). Associate: Mr. R. H. Phillips, T.D. (assistant district manager, Midland Area, General Electric Co., Ltd.).

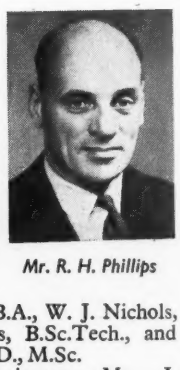
The new officers and committee members of the various sections are as follows:—

Measurement and Control: Chairman, Mr. H. S. Petch, B.Sc.(Eng.); vice-chairmen, Messrs. J. K. Webb, M.Sc.(Eng.), B.Sc.Tech., and Prof. A. Tustin, M.Sc.; members, Messrs. E. W. Connon, B.Sc.(Eng.), M.Eng., C. G. Garton, A. J. Maddock, D.Sc., and G. A. V. Sowter, Ph.D., B.Sc.(Eng.).

Radio and Telecommunication: Chairman, Mr. J. S. McPetrie, Ph.D., D.Sc.; vice-chairman, Mr. M. J. L. Pulling, O.B.E., M.A.; members, Messrs. R. J. Halsey, C.M.G., B.Sc.(Eng.), B. G. Pressey, M.Sc.(Eng.), Ph.D., and W. E. Willshaw, M.B.E., M.Sc.Tech.

Supply: Chairman, Prof. M. G. Say, Ph.D., M.Sc.; vice-chairmen, Messrs. J. E. L. Robinson, M.Sc., and D. P. Sayers, B.Sc.; members, Messrs.


Dr. J. B. Higham


Mr. R. H. Phillips

C. H. Flurschein, B.A., W. J. Nichols, B.Sc., J. E. Peters, B.Sc.Tech., and A. L. Williams, Ph.D., M.Sc.

Utilisation: Chairman, Mr. J. Vaughan Harries; vice-chairman, Mr. R. A. Marryat, B.Sc.(Eng.); members, Messrs. W. J. Gibbs, D.Sc., R. P. McCulloch, B.Eng., W. G. Thompson, Ph.D., B.Sc., and Lt.-Col. R. J. Harding, T.D.

The London Graduate and Student Section has elected the following officers for the 1957-58 session:—Chairman, Mr. F. L. Fielding (Standard Telephones & Cables, Ltd.); vice-chairman, Mr. J. F. Outram (Fulham power station); and hon. secretary, Mr. L. A. Harris, B.Sc.(Eng.) (Marconi's Wireless Telegraph Co., Ltd.).

Electric v. Oil Heating

The Brighton Entertainments Committee has been considering the provision of new water heating equipment at North Road Baths and after comparing the respective cost and other factors of heating by electricity and by oil has recommended the placing of a contract with Santon, Ltd., for the supply of electrical equipment at a cost of £649. It was reported that in addition to the equipment for electric heating, the provision of a new a.c. supply would cost £200 and other work £800. The Medical Officer, it was stated, had intimated that heating by electricity was preferable in view of the Clean Air Act.

I.E.E. Summer Meeting

North-Western Centre Entertains

THE I.E.E. Summer Meeting opened last week in the North-Western area when, on the Monday evening, the members were received at the Town Hall by the Lord Mayor and Lady Mayoress of Manchester, Alderman Leslie Lever, J.P., M.P., and Mrs. Lever, supported by Sir Gordon Radley, President, I.E.E., and Lady Radley. The reception was followed by dancing, a concert and light refreshment.

On Tuesday morning members were formed into parties for visits to a dozen different works and installations. The party which visited the new West Gorton factory of Ferranti, Ltd., was much impressed by the intricate production and delicate assembly of the "Pegasus" and "Mercury" computers and saw an excellent example of materials handling in the manufacture of distribution transformers. Those who visited the Hollinwood (Avenue) works of the same company saw the production of large power transformers and high-voltage testing equipments on an extensive scale, this factory having a capacity of over 5 million kVA per annum.

Another party went to the Carrington power station of the North West, Merseyside and North Wales Division of the Central Electricity Authority, which was described in the *Electrical Review* of 27th July, 1956. The station contains four Metro-Vick 60 MW three-cylinder hydrogen-cooled turbo-alternator sets which are served by seven 360,000 lb/hr Babcock & Wilcox boilers at 940 lb/sq in and 920 deg F.

In addition to a demonstration of a crane powered by eddy current slip couplings with special control gear, members who visited the Vaughan Crane Co., Ltd., also saw a new type of crane crab, having electronic control gear with pre-set speed control.

We think that the work which mostly interested the visitors to the Salford Electrical Instruments factory was that of processing quartz crystals, together with the manufacture of synthetic sapphire which they saw carried out at the Times Mill plant.

At the works of Ferguson Pailin, Ltd., the visitors had an opportunity of seeing the manufacture of switchgear for power stations, etc., ranging from circuit-breakers for the 275 kV supergrid down to small 415 V metalclad switch units for use in factories.

At the Trafford Park works of Lancashire Dynamo & Crypto, Ltd., visitors saw a compact medium-sized manufacturing unit of 1,500 employees engaged in producing rotating electrical machines from 25 kVA to 7,000 kVA. The products include synchronous and asynchronous induction motors, alternators, d.c. generators and motors and combinations of these machines in multi-unit sets.

There were other visits to the College of Science and Technology, Manchester, and to the factories of Renold Chains, Ltd., Sunnyside Stitching & Knitting, Ltd., and the Lancashire Cotton Corporation, Ltd., and there were also coach tours to places of architectural interest in central Manchester.

All the members met at the Midland Hotel for lunch as the guests of Ferranti, Ltd., when Mr. S. Z. de Ferranti presided in the absence of his father, Sir Vincent de Ferranti, who was in Russia.

Hospital X-Ray Equipment

The Tuesday afternoon was devoted to another round of visits which included the Christie Hospital and Holt Radium Institute where the main theme presented was the accurate application of high energy X-rays in the treatment of disease, principally cancer. The equipment includes 250 kV and 500 kV X-ray sets, a 4,000 kV linear accelerator and a 20,000 kV betatron.

Those members who went to the Trafford Park factory of W. T. Glover & Co., Ltd., watched wire-drawing and the production of paper, rubber and thermoplastic insulated cables. The main features of interest at the Park works of Mather & Platt, Ltd., were the manufacture of rotating electrical machinery of up to 1,500 b.h.p. and the production of centrifugal pumps of all sizes.

Right: The visitors to Metropolitan-Vickers works saw one of two 50 MVA 428 r.p.m. vertical type waterwheel generators for the hydro-electric scheme at Rossaga, Norway (see "Electrical Review" of 4th, 11th and 18th May, 1956)

Below: Assembly on the "Pegasus" computer production line at the West Gorton factory of Ferranti, Ltd.

Left: Sir Gordon Radley and the Lord Mayor and Lady Mayoress after the civic reception on Monday evening

Right: Mr. & Mrs. E. T. Norris and Mr. & Mrs. J. D. Peattie at the reception for Thursday evening's I.E.E. dinner

Visitors to the works of the Simon Engineering Group at Stockport saw the demonstration room, the "Select-o-Weigh" department, an experimental flour mill, the power department and the engineering shops.

Those members who visited the Manchester University Electrical Engineering Department inspected, *inter alia*, the new high-voltage laboratory which houses a one million volt d.c. generator, the Ferranti Mark I electronic computing machine, and the high vacuum laboratory. In addition, there were visits to the soap factory of Thomas Hedley & Co., Ltd., the Irlam works of the Lancashire Steel Corporation, Ltd., and the cigarette factory of J. A. Pattreiouex, Ltd.

Reception at Manchester University

On Tuesday evening there was a reception at the Whitworth Hall of the University of Manchester by the Vice-Chancellor, Professor W. Mansfield Cooper, LL.M., and Mrs. Mansfield Cooper.

On Wednesday there was an all-day tour of the Lake District which took in the Calder Hall nuclear energy generating station. A description of this station was published in the *Electrical Review* of 19th October, 1956, together with a special drawing by an engineering artist.

As alternatives to the Lake District tour there were an inspection of the Manchester Ship Canal, which involved a walking tour of the dock area followed by a launch trip on the canal; and a visit to the studios, control rooms, etc., of Granada TV Network, Ltd.

There were other works visits on Thursday morning which included the works of Metropolitan-Vickers Electrical Co., Ltd., where in the research department the visitors saw a display which included examples both of current work, including research in connection with materials used in nuclear power reactors, and of new products evolved from the company's research work.

Some of the party went to Bradford Colliery where they saw a Koepe coal winding hoist and the top of an upcast shaft; coal preparation plant; the coal tunnel to Stuart Street power station; a men and materials hoist at the downcast shaft and the new power station. There was also a visit to the Shirley Institute, Didsbury, of the British Cotton Industry Research Association. All members who took part in the visits on Thursday morning lunched as the guests of the Metropolitan-Vickers Electrical Co., Ltd., at the company's works, with Dr. C. Dannatt, O.B.E., M.C., in the chair.

After a free afternoon, members enjoyed a dinner-dance in the evening at the Midland Hotel, Manchester, under the chairmanship of Sir Gordon Radley who proposed "The City and Port of Manchester" to which Alderman R. S. Harker, J.P., replied. Mr. T. E. Daniel, M.Eng., chairman of the North-Western Centre, proposed the toast "Our Guests" and Mr. J. P. A. Meldrum, O.B.E., B.Sc., responded.

Friday saw another day excursion when most of the visitors toured the Peak District, visiting Wilmslow, Alderley Edge, Macclesfield and Buxton where, at the Palace Hotel, they were the guests at luncheon of the North Western Electricity Board and the C.E.A. North West, Merseyside and North Wales Division. There was a dual chairmanship at this lunch, Mr. T. E. Daniel representing the Board and Mr. A. R. Cooper, M.Eng. (controller), representing the Division. Mr. T. E. Goldup, President-Elect, I.E.E., briefly replied to an address of welcome by Mr. Cooper. Alternative morning and afternoon visits to the all-day excursion included factories which had already been visited during the earlier part of the week.

The meeting was concluded last Friday evening by a supper-dance and cabaret at the Free Trade Hall at which the members were guests of the Metropolitan-Vickers Electrical Co., Ltd.

S.I.M.A. Luncheon

ON Friday last the annual luncheon of the Scientific Instrument Manufacturers' Association was held at the Savoy Hotel, London. The occasion was also marked by the publication by the Nucleonics Group of the Association of the fourth edition of the well-known "isotope book." With the title "British Nucleonic Instruments 1957" this comprehensive volume of 176 pages lists the sources of supply of all kinds of nucleonic instruments, accessories, and other equipment for the handling and application of radioactive isotopes, for atomic power station instrumentation, and for laboratory, industrial and medical uses of the new isotope techniques. Over ninety firms are represented in the book, most of them listing and illustrating their particular products. A classified "buyers' guide" section enables the user to make a quick selection of possible sources. Priced at 10s 6d the book is available from S.I.M.A., or through booksellers.

The guest of honour at the luncheon was Mr. R. A. Butler, M.P., who was introduced by the president of the Association, Mr. G. A. Whipple. Mr. Butler made a short speech in which he stressed the importance of the British scientific instrument industry to the nation and congratulated S.I.M.A. on its achievements. He felt sure that this country would always lead the world if we trusted to our skill and powers of improvisation; however, we must fight the menace of inflation by increasing both production and skill. A toast was proposed to the guests by Mr. P. Goudim, vice-president. A brief, witty response was made by Sir John Maud.

PARLIAMENTARY REPORT

Board Members' Salaries

When the Prime Minister, Mr. Harold Macmillan, announced pay increases for Ministers and M.P.s last week he added that the Government would also increase the pay of members of the nationalised boards. He said that the Government had decided that the long-deferred adjustment of salaries of members of these Boards should now take place. Without going into details, he gave two figures to illustrate the order of the adjustments. The maximum salary of the chairman of a major Board would be raised from £8,500 to £10,000, while that of a member of such a Board would be raised from £5,000 to £7,000. In accordance with precedent, and in some cases with statutory requirements, the changes would be reported to Parliament in detail in due course. A convenient date for these changes was 1st July. It was announced later that a White Paper giving details of the salary increases to be paid to the chairmen and members of the Boards would be issued shortly.

Purchase Tax

Later a number of M.P.s tried to persuade the Government to reduce the various rates of purchase tax on consumer goods but their amendments were resisted and defeated in the division lobbies. Mr. Charles Royle, appealing for the 60 per cent rate of tax on refrigerators to be reduced, said that the Government had the idea that refrigerators were luxuries. They had in fact become necessities. In Shoreditch and Finsbury every one of the 3,000 municipal flats built since the war had a domestic refrigerator, and this showed that the Corporation recognised that they were essential to the modern housewife.

Alternate Supplies

Mr. Hastings asked the Paymaster General if he would give a general direction to the Central Electricity Authority to provide an alternate supply of electricity to all areas so that all current may not be eliminated in severe storms.

Mr. Reginald Maudling, in reply, said that the electricity authorities were already spending large sums to safeguard supplies during emergencies and the cost of attempting to provide against all risks would be prohibitive.

Fuel Requirements

Mr. Moss asked the Paymaster General if he would estimate, in the light of the most recent information available to him, what proportion of the national energy requirements would be met in 1965 from coal, oil, hydro-electricity, and nuclear power stations, respectively, showing how this compared with 1956.

Mr. Maudling said that on present supply plans we could expect the percentage of inland energy requirements met by oil and hydro-electricity to increase from 15 to about 20 per cent and from 0·5 per cent to 0·75 per cent, respectively, while nuclear power grew to 4 or 5 per cent. The percentage met by coal might fall from 85 to 75 per cent but the tonnage of coal used at home should increase appreciably as should the amount exported.

Exports to China

Mr. John Rankin asked the President of the Board of Trade when he expected to complete the determination of export quotas for goods on the quantitative control list for China, and whether the quotas now being established would apply only to exports from this country or would be part of larger quotas shared with other members of the Paris Consultative Group.

Sir David Eccles replied that recommendations as to these quotas were due to be made by the Paris Consultative Group to member governments in the near future. Some of the agreed quotas would probably operate globally; the rest would be allocated as between the countries concerned, but there would be some room for adjustment.

Nigerian Development

Mr. E. L. Mallalieu asked the Under-Secretary of State for the Colonies what were the results of the investigation of the hydro-electric potential of the Niger River and of the Cameroon Mountains undertaken by the Nigerian Government.

Mr. Profumo said he was obtaining this information from the Acting Governor-General of the Federation of Nigeria.

Volta River Project

Mr. E. L. Mallalieu also asked the Under-Secretary of State for Commonwealth Relations what assistance had been offered by the United Kingdom Government to the Government of Ghana for the development of the Volta River project.

Mr. Alport replied that the general position was still as stated by the Secretary of State for the Colonies on 27th July.

Mr. Mallalieu asked that in view of the vast difference which the realisation of this project could make to Ghana did not the Government think that they would be well advised to offer a proportion of the financial cost of the scheme—say one-third.

Mr. Alport replied that the United Kingdom and Ghana Governments and the aluminium companies had each reaffirmed their interest in the project. The Ghana Government had given a group of United States companies until 18th July to survey the project and to enter into negotiations to undertake it. The matter therefore rested with the Ghana Government at the moment.

Tariff Protection

Mr. Osborne asked the President of the Board of Trade what were the 20 biggest, in percentage, of the tariffs or protections to British industry that would be lost as a result of the adoption by the United Kingdom of the European free trade proposals.

Sir David Eccles gave a list of the main classes of goods subject to a duty of 33⅓ per cent *ad valorem* when imported into the United Kingdom, if they did not qualify for Imperial Preference. These included a few iron and steel manufactures, scientific instruments (most types), cinematograph projectors and some cameras, and radio valves and vacuum tubes.

Lloyd-Mandeno Earth Return

Mr. Vane asked the Paymaster General how far the five experimental schemes employing the Lloyd-Mandeno single-wire earth return had progressed; in which counties they were sited; and when he expected to be able to make a statement.

Mr. Maudling said this work was being carried out by the industry as part of its normal programme of research and development and it would therefore be for the industry to announce the results. He was informed, however, that these schemes (of which two were in Dorset and one each in Buckingham, Somerset and Wiltshire) had so far been operating satisfactorily. It was intended to bring a further seven schemes into operation before attempting to draw firm conclusions from the programme and the results were not therefore likely to be available before next summer.

Hastings Trolley-Buses

The Hastings Corporation (Tramways) Bill, to permit the electric trolley-buses of Hastings to be replaced by diesel buses, was objected to when it was presented for second reading in the House of Commons and it will be debated shortly. Mr. Gerald Nabarro, supported by Mr. A. M. F. Palmer and other M.P.s, has put down a motion refusing a second reading on the ground that trolley-buses use home-generated electricity and are fumeless, whereas diesel buses use imported fuel and give off exhaust fumes. A date has not yet been fixed for the debate.

INDUSTRIAL NEWS

Import Licensing Relaxations

The President of the Board of Trade announced in a written reply to a Parliamentary question on 2nd July that import controls were to be removed from a large number of commodities on 1st August. This mainly affects goods imported from the dollar area. A detailed list of the goods shows that there is no alteration in the licensing of electrical goods. Existing restrictions will continue to apply to dollar imports of machinery, fuels and most manufactured products.

Among the items for which individual licences will not be required are non-ferrous (including aluminium) castings; tubes, pipes and hollow bars of all sections; uninsulated wire; wrought bars, rods, shapes and sections; and wrought plates, sheets, strip and foil.

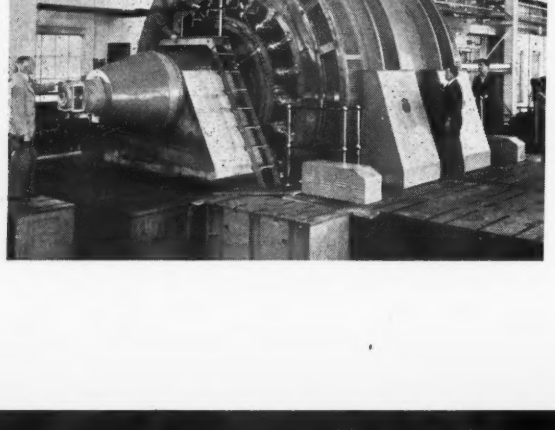
E.T.U. Finances

It is reported that Mr. F. L. Haxell, the secretary of the Electrical Trades Union, is confident that any financial setback experienced by the Union will be overcome by the end of this year. The Union still had £500,000 in hand. If a special rules revision conference to be held in September accepts proposals which will be put before it for increasing members' contributions the Union hopes to be able to re-open its convalescent home early next year and its Esher training college in due course.

Rolling Mill Motor

One of the largest d.c. rolling mill motors ever manufactured in Great Britain was completed recently in the British Thomson-Houston Co.'s Rugby Works. It is rated at 7,000 h.p., 50/100 r.p.m. with a peak capacity of 21,000 h.p. and is for driving a 43in reversing cogging mill at the Templeboro Works of Steel, Peech & Tozer. The new motor will replace one installed by the B.T.H. Co. in 1919. The flywheel motor-generator set for supplying the motor was installed in December, 1956, and the new motor will be installed during the coming August. Its associated control gear embodies the latest form of amplidyne control designed to give very high rates of acceleration and retardation combined with accurate peak load limitation. The armature of this motor weighs over 100 tons. It is of the double-unit type without through shaft, the two units being bracketed together at the centre. This will enable the armature to be split for ease of transport and erection.

A large rolling mill motor on test at the B.T.H. Rugby Works



Thorn Electrical Industries Developments

A special type of multi-pin plug and socket connector for use in guided missiles and supersonic aircraft, made in the United States by the Bendix Aviation Corporation, are to be made in this country by Thorn Electrical Industries, Ltd. It is stated that this will save Great Britain millions of dollars during the next few years. These connectors will operate effectively in extreme temperatures at great heights and will withstand the vibration and stresses to which they are subjected in guided missiles and supersonic aircraft.

Thorn Electrical Industries have acquired the Champion Electric Corporation, Newhaven Cabinet Works, Ltd., and Austin Clark (London), Ltd., the group operating in the fields of radio, radio and television cabinets, and domestic appliances, with factories at Newhaven, Sussex.

Board Employee's Prompt Action

Mr. W. L. Gordon, an employee of the Eastern Electricity Board, was recently called in to repair a water heater in a house at Grays Thurrock and while he was trying to withdraw the fuses the lid of the metal box containing the meter, which was alive, came into contact with the adjacent gas pipes. The heavy current of electricity which flowed to earth fractured the gas pipes and set fire to the gas and in a few moments clothing which was kept in the cupboard was alight. Despite the flames Mr. Gordon thrust his way past the burning clothing and managed to reach the tap controlling the gas. He was taken to hospital but was allowed to go home after attention. In recognition of his prompt action the E.E.B. has presented him with a cheque for £20, and the presentation was made recently by the deputy chairman of the Board, Mr. H. D. B. Wood.

Telephone Exchange Orders

An order valued at £165,000 has been received by Siemens Edison Swan, Ltd., for a 5,400 line automatic telephone exchange for Pinelands in the Western Cape area of South Africa. Two further orders for automatic telephone exchange equipment have been received from New Zealand. They cover extensions to the Hamilton City and Beckenham exchanges.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

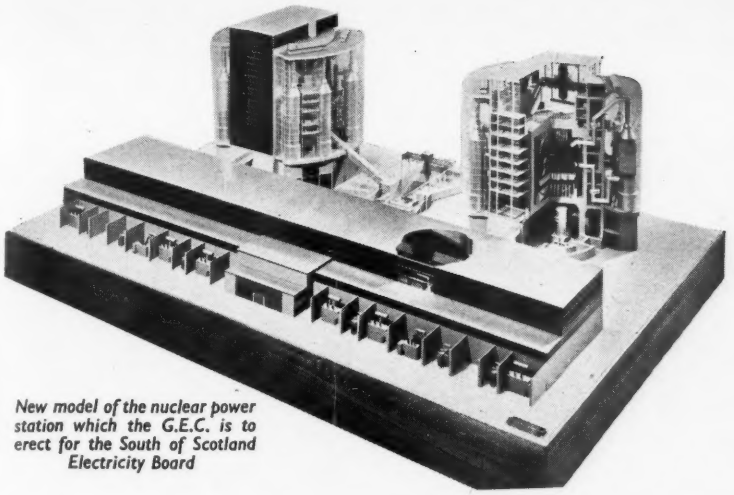
ALUMINIUM ingots	ton £197 0s 0d
COPPER, H.C. Electro	ton £221 5s 0d
Fire Refined 99·70%	ton £220 0s 0d
Fire Refined 99·50%	ton £219 0s 0d
COPPER Tubes ..	lb 2s 1¼d
Sheet	ton —
H.C. wire and strip ..	ton £271 5s 0d
LEAD, English ..	ton £91 5s 0d
Foreign	ton £90 0s 0d
MERCURY	flask £90 0s 0d
TIN, block (English) ..	ton £759 0s 0d
ZINC, G.O.B. Foreign	ton £77 5s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 1s 9¼d
Sheet	ton —
Wire	lb 2s 6d
PHOSPHOR BRONZE Wire	lb 3s 10½d
PLATINUM	oz £34 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 27⅜d—27⅝d

All-Electric Caravan Park

The holiday resort of Dawlish (South Devon) now has an all-electric caravan park. About 50 caravans have electric light, water heaters and cookers and re-diffusion radio. Prepayment meters have also been installed.

Atomic Power Station Model

We reproduce a new scale model of the G.E.C. design of atomic power station which is being shown for the first time in Amsterdam at the "Het Atoom" Exhibition, which opened on 28th June and continues until 15th September. The model represents part of the station which is to be built for the South of Scotland Electricity Board, and is on display on the Board of Trade stand together with exhibits



New model of the nuclear power station which the G.E.C. is to erect for the South of Scotland Electricity Board

from the U.K. Atomic Energy Authority.

It is built to a scale of $\frac{3}{32}$in to the foot and shows the two 200ft high reactor buildings and the turbine hall, one reactor and part of the turbine hall being sectioned to reveal details of construction and operation.

"Distribution of Electricity"

Upon entering its thirtieth year of publication *Distribution of Electricity*, produced by W. T. Henley's Telegraph Works Co., Ltd., has reverted to its pre-war format. All the usual features are retained and this issue (July) contains an illustrated report of the British Electrical Power Convention at Eastbourne.

A.S.E.E. Diplomas and Certificates

The Association of Supervising Electrical Engineers has published the results of its 11th annual examinations under its Diploma Scheme held in May. Diplomas in electrical installation have been awarded to Messrs. E. F. Cooper (Twickenham), S. J. Rigby (Birmingham) and J. R. Smith (Bath) and in electrical maintenance work to Mr. A. W. Morewood (Workington). In addition sixteen technicians' certificates have been awarded.

The A.S.E.E. Diploma Scheme provides engineering personnel in the electrical and allied industries with proof of their practical and technical ability within the scope of their specialist training and experience. Full details of the scheme and copies of the regulations and syllabuses may be obtained from the general secretary, A.S.E.E., 23, Bloomsbury Square, London, W.C.1.

Wholesalers' New Premises

Last week H. E. Kettle, Ltd., members of the Electrical Wholesalers' Federation, opened new branch premises at 12, Salisbury Road, Bromley, Kent. There the company holds stocks of electrical, radio and television equipment and cycle accessories and it has a daily service between the branch and the Maidstone headquarters.

The business was started by Mr. Henry Kettle at Smarden, Kent, in 1902 and was moved to Tenterden in 1914 and to Maidstone in 1921; the present Maidstone premises, in Knightrider Street, were acquired in 1935.

Generation in Great Britain

Since the publication of the above survey in *Electrical Review* of 14th June last our attention has been drawn to two errors in the low density shading of the special map which accompanied the article.

In one case the Shropshire and Herefordshire Sub-Area of the Midlands Electricity Board is shown as in the "1,001 to 2,000 kW per sq mile" category, whereas it is in the "below 80 kW per sq mile" class. Secondly, the Devon and Cornwall Sub-Areas of the South Western Electricity Board are shown as being in the "251 to 1,000 kW per sq mile" class whereas they should be in the "80 to 250 kW per sq mile" category.

Colour-Light Signalling Contract

A contract recently awarded to the Siemens & General Electric Railway Signal Co., Ltd., by the Southern Region of British Railways for new colour-light signalling on the Kent Coast electrification extension covers 28 miles of double-track main line from Farningham Road to Sittingbourne, together with the 7½-mile branch line to Sheerness. Three interlocking control panels will be provided in new signal boxes at Rochester, Rainham and Sittingbourne, and the whole of the Sheerness branch will be controlled by remote control methods from the panel at Sittingbourne. A relay interlocking control panel combined with an illuminated track diagram will also be provided at Farningham Road to work in conjunction with the existing mechanical lever frame. Altogether ten signal boxes will be dispensed with on the section to be resignalled. The contract includes plug-in relays, impedance bonds, colour-light signals, shunt signals, combined type electric point machines, multi-core signalling cables, power mains cables and associated equipment, telecommunications cables for signal post telephones, lever locks, detonator placer machines, and power equipment for level crossing gates. The work is to be completed by June, 1959.

I.E.C. in Moscow

Strong representation of British electrical manufacturers, consultants, the electricity supply authorities and other interested bodies has been the feature of the meeting of the International Electrotechnical Commission in Moscow. A wide range of machinery and equipment has been considered from the international standardisation aspect. A report by one of the delegates will appear in a subsequent issue of the *Electrical Review*.

Electricity Farm

One of the most prominent features of last week's Royal Agricultural Show at Norwich was the British Electrical Development Association's "Electricity Farm." The photograph reproduced with this note shows Mr. J. I. Bernard, director and secretary of E.D.A., at the farm with Messrs. C. T. Melling, chairman of the Eastern

Messrs. J. I. Bernard, C. T. Melling and W. S. Lewis at the Royal Show

Electricity Board, and W. S. Lewis, chairman of the Midlands Electricity Board and of the E.D.A. Council. They are examining an electrically-heated propagating frame.

Indian Import Licensing

Drastic changes in India's import licensing policy are reported in the *Board of Trade Journal*. The new policy covers the period from July to September only; the next six-monthly policy will be announced at the end of September when it is hoped that the foreign exchange position will be clearer. Broadly the new policy restricts the issue of import licences to

essential raw materials and to capital goods supplied on deferred credit.

To avoid any disruption of supplies needed to sustain industrial production, actual user applications will be considered for essential raw materials and certain other miscellaneous items, among which h.v. insulators are mentioned. Intending importers of capital goods are to put their case to the Chief Controller of Imports who may prescribe deferred payment terms on which an import licence will be issued. Preference will be given to goods needed to complete existing schemes.

Hydro-Electric Plant for Jamaica

The Jamaica Public Service Co., Ltd., has awarded a contract to the Harland Engineering Co., Ltd., for generating plant to be installed in Maggotty Falls power station. The "Harland-Morgan Smith" hydraulic turbine is of the vertical shaft, Francis type, rated at 8,400 b.h.p. under a net head of 290ft, driving a 7,500 kVA Harland a.c. synchronous generator. The unit is specially designed for operation at an initial frequency of 40 c/s, with easy conversion to 50 c/s in the future. Arrangements have been made for fully-automatic local and remote control, which had been previously adopted at the Lower White River and Rio Bueno generating stations, also equipped with Harland plant.

Television for Traffic Control

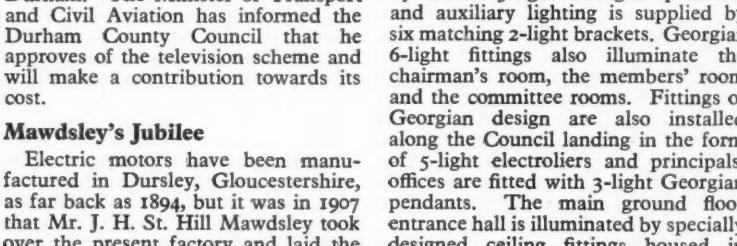
Britain's first permanent television installation for traffic control is to be set up in the Market Square at Durham. The Minister of Transport and Civil Aviation has informed the Durham County Council that he approves of the television scheme and will make a contribution towards its cost.

Mawdsley's Jubilee

Electric motors have been manufactured in Dursley, Gloucestershire, as far back as 1894, but it was in 1907 that Mr. J. H. St. Hill Mawdsley took over the present factory and laid the foundations for the "Zone" works. The jubilee was celebrated at the factory on 26th June when the chairman of the company, Lord Gridley, was present at a celebration luncheon attended by representatives from many engineering concerns throughout the country.

Lord Gridley described the occasion as another red letter day in the history of the company. During the day the 413 employees and their friends were entertained to tea and an inspection of the factory which included the new extension. Speaking at the luncheon, Mr. A. J. Thomas, of Cam, who has been associated with the company for over sixty years, told of the early history of the factory under Mr. Mawdsley. Tremendous advances had since been made under the chairmanship of Mr. A. H. Topham (unable to be present because of admission to hospital). Lord Gridley said the output in a year was twenty times greater than in 1924. With the new extensions they were in a position to considerably increase that output.

Mr. A. W. Field extended a welcome to the guests and Mr. W. C. M. Couch (Admiralty) replied on their behalf.



At the jubilee luncheon of Mawdsleys, Ltd. Left to right: Mr. A. J. Thomas, Mrs. I. St. Hill Mawdsley, Lord Gridley, Mr. W. C. M. Couch, Mrs. V. St. Hill Thompson and Mr. E. V. Giles

Lighting of New Cheshire County Hall

The main public rooms of Cheshire's new County Hall at Chester, which was to be opened yesterday (Thursday) by the Queen, accompanied by the Duke of Edinburgh and Lord Leverhulme, Lord Lieutenant of the county, are equipped with a G.E.C. lighting system of traditional and contemporary designs. The Council chamber is lit by six special G.E.C. Georgian fittings finished in satin brass. The lady members' room is lit by G.E.C. 5-light Georgian pendants and auxiliary lighting is supplied by six matching 2-light brackets. Georgian 6-light fittings also illuminate the chairman's room, the members' room and the committee rooms. Fittings of Georgian design are also installed along the Council landing in the form of 5-light electroliers and principals' offices are fitted with 3-light Georgian pendants. The main ground floor entrance hall is illuminated by specially designed ceiling fittings housed in ceiling recesses. Illumination in the main assembly room, the King George VI Hall, is provided by six contemporary design satin brass pendants with eight matching brackets. Lighting in the annexe to the hall is supplied by twenty 3-light fittings with metalwork in satin brass with white relief and eighteen matching brackets.

Georgian lighting fittings in the Council Chamber of the new Cheshire County Hall, in which all the principal rooms are equipped with G.E.C. lighting fittings

Lighting of the approach roadway to the new County Hall also employs G.E.C. equipment. This consists of thirteen post-top lanterns housing tungsten lamps; seven lanterns are mounted on cast iron columns, and six are attached to cast aluminium brackets for wall mounting. Cable used throughout the new building was supplied by the Pirelli-General Cable Works, Ltd., and the installation was under the direction of the Cheshire county architect, Mr. E. Mainwaring Parkes, F.R.I.B.A. The electrical contractors were G. Hallam, Ltd., Stockport.

Trade Announcements

Philips Electrical, Ltd., has introduced a radiation protection service which will be operated by the company's research and control instruments division. This service offers consultation on X-radiation protection problems. It also provides for the planning and equipping of complete X-ray departments with all necessary protective measures, as well as the revision of such measures in existing departments.

Sciaky Electric Welding Machines, Ltd., Slough, has transferred Mr. E. C. Longmore to its northern area sales staff. Mr. Longmore (telephone: Sale 9119) joins Mr. V. C. Cadle who has been resident in Manchester for the past five years.

Bill Switchgear, Ltd., has now arranged independent premises and area branch facilities under the management of Mr. J. Ballentine at 23, Bedford Street, Belfast (telephone: Belfast 27384).

VIEWS on the NEWS

By REFLECTOR

IT was the principle of earlier transport operators to charge what the traffic would bear, but in London now the limit appears to have been reached. At last week's meeting of the Transport Tribunal a member of the London Transport Executive admitted that higher fares had resulted in a loss of passengers. Yet the system has to pay its way. Even more than the electricity supply industry, London Transport is bedevilled by the peak problem. Apparently it has had little success with its "off-peak" fare concessions. It seems that relief (and consequent economy in operation) can come only from a staggering of workers' times of starting and stopping and there is a reluctance among both employers and employees to pursue this.

* * *

As one connected with the *Electrical Review* I was naturally pleased to see the journal's special drawing of the Calder Hall nuclear power station in evidence during the visit to that establishment of members of the I.E.E. during their Summer Meeting. Our guide made great use of it in explaining the construction and operation of the reactor and the associated heat-exchanger plant. The drawing also appears in the nuclear power section of the new Electric Power Collection at the Science Museum, South Kensington, and it is in use at many technical colleges and by other educational organisations.

* * *

A *Daily Telegraph* columnist believes that the people in the hills and dales of the West and East Ridings make the best use of electricity, and she says they have the cheapest electricity in Yorkshire:—

> "A new domestic tariff started this quarter cuts the cost of electricity to 0·825 of a penny if you use enough. First the consumers pay 5d a unit, then 1d and finally this lowest-ever rate."

She is probably too young to remember the "Point Fives" whose aim was to charge a running rate of ½d a unit.

Later the writer echoes Dr. de Ferranti when she says she looks forward to the day when electricity will be so plentiful that we shall pay for it as we now pay for piped water or rates, in a fixed half-yearly sum.

* * *

I recently commented on the unrewarding nature of many rural consumers' installations. Writing to the *Financial Times* Mr. H. Gregory (Maulden, Beds) says that rural electrification does not pay its way because much education remains to be done among farmers. He thinks that farmers' wives would like to have labour-saving appliances but they find this well-nigh impossible in the face of the 50 per cent initial deposit required on almost all really useful electrical domestic appliances. I agree with Mr. Gregory when he suggests that a reduction of the deposit would go a long way towards helping the rural electrification campaign to pay for itself. And, I would add, a reduction (or total remission) of purchase tax on many appliances.

* * *

Commenting upon the subject of "wire-tapping" in his Parliamentary notes in the *New Statesman*, Mr. J. P. W. Mallalieu says:—

> "Some of the others [Members of Parliament] who believe that telephone-tapping in some circumstances is justifiable do not believe that in present circumstances it is legal. They say that there is no record, at any rate since 1189, of the prerogative being extended to cover this practice and that any prerogatives created before that date would hardly deal with telephones."

Nor, I should think, any prerogatives created for about seven centuries after that date.

* * *

In this era of rapid advance one has to be very chary of claiming records. Recently the American *Atoms for Peace Digest* claimed that a high-power travelling-wave 24 million eV electron accelerator with 10 kW of radiation, to be installed at the U.S. Army's Ionising Radiation Centre, Stockton, California, would be the most powerful of its kind ever produced. Now, however, the journal says that it has been informed by the Metropolitan-Vickers Electrical Co. that a travelling-wave linear accelerator which it is building for the Harwell Atomic Research Establishment has a designed output of 30 kW of radiation and is rated at 25 million eV. It is evident that an International Bureau of Records is needed.

* * *

Seventy years ago the pioneers of electric lighting were making slow headway against the prejudices of municipal authorities, many of whose members were interested in the local gasworks. For instance, there was trouble at Bath, reported in the *Electrical Review* of 15th July, 1887, as follows:—

> "Some misunderstanding has arisen at Bath between the civic authorities and Mr. H. G. Massingham, who has been introducing the electric light into that city. The Town Clerk wrote that he was instructed by the Corporation Property Committee to request Mr. Massingham to remove the poles used for some installations by the following day, whereupon the latter replied that he could not undertake to do so at so short a notice, but promised that the electric light should not be exhibited in the city after the following night, and that the poles and wires should be removed as quickly as possible. Mr. Massingham added, 'I cannot but express my surprise that a body which is supposed to exist solely for the public good should adopt this means of enforcing the discontinuance of the electric light in Bath.'"

New Particle Accelerator

THE United Kingdom Atomic Energy Authority has requested Metropolitan-Vickers Electrical Co., Ltd., to collaborate in the design of two tandem electrostatic generators for use at Harwell and Aldermaston. The main parts of these machines will be made at the Trafford Park works. They will facilitate research into the nuclear properties of uranium and similar elements and will enable energetic neutrons to be produced for other nuclear work.

Unlike the Van de Graaf accelerator the tandem generator produces acceleration in two stages. Negative hydrogen ions are first accelerated from earth potential to an energy of 6 MeV. They are then fired into a "stripper," which removes the electrons from the outer shells of the atom and leaves the ions still moving in a forward direction with a net positive charge but with energy almost unchanged. The second stage of acceleration is achieved by bringing the positive ions back to earth potential, so that the total energy communicated to the ions is 12 MeV. In this way, ions are accelerated to an energy twice as great as could be achieved in a single stage, while the insulation problems are exactly the same as in a single-stage machine. As a general rule, negative ions are more difficult to form than positive ions, and therefore the beam current in a tandem machine is smaller than in a single-stage machine, but this is a small price to pay for the saving in insulation.

The tandem generator is housed inside a pressure vessel 45ft high and 9ft in diameter, which contains an insulating belt mounted on pulleys some 16ft apart. The belt moves at 3,000 ft/min, and an electric charge sprayed on to its lower end is carried to the central terminal where it is collected. The charge leaks back to earth through two potential divider chains, one going to the lower and one to the upper end of the vertical column. To reduce the danger of voltage breakdown, the spaces between the central terminal and the upper and lower ends of the column are each sub-divided by 150 equipotential plates, connected to the potential divider chains at the appropriate tapping points. The accelerator tube is situated inside the "stack" of equipotential plates and passes right through the ends of the pressure vessel. The tube is sub-divided by conducting rings, each connected to its corresponding equipotential plate, the aim being to limit the voltage across any one section of tube to 40 kV.

Negative ions are formed in a high-frequency gas discharge and are withdrawn from the discharge by preliminary accelerating electrodes, which are designed to produce a focused beam of circular cross-section and fire this down the centre of the main accelerating tube. Electrons are stripped from the negative ions by passing them through an extremely thin foil inside the central terminal. On emerging at the lower end of the accelerator tube the beam is passed through a magnetic field adjusted to deflect the ions through a right-angle and bring the beam to a focus on the particular target under investigation.

The vessel containing the accelerating electrodes is pressurised at 250 lb/sq in, the weight of gas being about two tons. For maintenance purposes this gas must be removed and stored, and a considerable proportion of the cost of this type of installation is associated with the equipment for transferring the gas from reservoirs to the pressure vessel and keeping it dry and free from atmospheric contamination.

In the equipment described, the ions may move distances of about 120ft before reaching their target, and the target area must not exceed a few millimetres in diameter. It is thus necessary to maintain a very high vacuum throughout the entire ion path and also to control all the accelerating and deflecting fields to a high degree of accuracy. The accelerator tube is pumped at the top and bottom, and also via a by-pass tube at the centre, by 14in mercury diffusion pumps with large dry ice traps and liquid air traps in series. The accelerating, focusing, and deflecting fields are controlled by electronic stabilisers to an accuracy of a few parts in 100,000.

Letter to the Editor

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents

Irradiating Insulation

IN the *Electrical Review* of 21st June, Mr. Wray asked for suggestions concerning dosimetry of irradiated materials and related matters to be discussed shortly by a sub-committee of the American Society for Testing Materials. Unfortunately, the definitions which he quotes are misleading in several respects; if this is due to typographical errors, they should certainly be corrected. The roentgen, for example, does not refer to one cm. and the REP is usually taken to be 93 ergs per gram.

Mr. Wray also quotes the equivalent of thermal neutrons in atomic reactors and in the literature issued by his company he refers to a "C" unit. As one of the people who originated this fictitious unit, I would like to draw attention to its failings and would be happy to see it disappear as soon as possible. The equivalence between a thermal neutron flux (and associated gamma and fast neutron flux) and radiation dose depend not only on the type of reactor and on the position of a specimen within it, but also on the chemical structure of the material being irradiated. Unless great care is taken, it would be quite easy to be misled by a factor of 10 when using such units.

We have been carrying out a considerable amount of work on radiation effects on materials and always specify our doses in megarads (which we prefer to write "Mrad" to distinguish them from megaroentgen written "Mr"). We have found this unit to be very convenient, particularly as it lends itself very readily to conversion into units of electrical energy.

The functions of Sub-committee 11, as given by Mr. Wray appear to cover a considerable ground of interest to scientists concerned with radiation effects and their applications. Could Mr. Wray provide further information on the terms of reference of this Sub-committee, and of the representatives on it?

Saffron Walden A. CHARLESBY, D.Sc.,
Head of Radiation Department,
Tube Investments Research Laboratories.

Prospect for Electrical Appliances

Competition for European Markets

By NICHOLAS A. H. STACEY*

IT is nothing short of remarkable that business in electrical appliances in recent years should have become one of the most hazardous undertakings in the electrical manufacturing industry. The risks have not arisen from the inescapable vagaries of orthodox economic forces; they have been "managed" risks, arising from the dictates of Government. These risks have not been eased in the recent Budget.

Some electrical appliance makers—the smaller specialist firms as well as the large companies—have reported either a downturn in profits, or a smaller profit ratio to turnover for 1956. Reduced demand resulted in significant cutbacks in production. Electrical appliance exports have not countered the fall in home demand, though more washing machines, toasters and vacuum cleaners, and significantly more fans and television receivers were sent abroad in 1956. However, the value of British appliance exports (including radio and television) in 1956 at £35·1 million remained practically unchanged over the previous year. This is all the more remarkable since the value of all electrical and allied exports rose during 1956 to £272·5 million or by 11 per cent. Hence the share of the appliance exports to the total fell back from 14·3 per cent to 12·9 per cent.

Two New Tasks

The depressive effects of higher purchase tax and of bigger down payments—the effects of the 1955 Autumn Budget—took their toll of the electrical appliance industry in 1956. The decline in home sales continued throughout the year, which is understandable since consumers' expenditure of household durables fell by 4 per cent. But, despite the many deterrents, the demand for electrical household goods has been slowly emerging from its previous nadir since the beginning of 1957. The moral is that demand for a wide range of non-luxury electrical appliances cannot be suppressed indefinitely by regulations; once the higher deposit is saved, the delayed investment becomes possible. And, since in 1956 personal savings reached 10 per cent of personal incomes—the highest in any year since the war—it is prudent to assume that the money is there.

Although the recent Budget has brought no relief for this sector of the electrical industry, it is this sector which, primarily, will have to negotiate two important hurdles now immediately ahead: the first is to undertake a further expansion of output, both in range and volume, and the second, which in turn is conditioned by the first, is to endeavour to compete successfully in the Common Market and in the emerging new European Free Trade Area.

Changing Trends

New trends are perceptible in the appliance business. Not only is the potential market expanding at home, and requires a revision of calculations for new sales and for replacement, but demand for entirely new appliances will also become more apparent. A list of the more important appliances, currently sold in the United States and little known or not yet manufactured in any volume in the U.K., includes broilers, dehumidifiers, food waste dispensers and deep fat fryers. As the range of appliances expands, new manufacturers making new products may enter the market, or established manufacturers may start producing new items. Much of appliance manufacture is, at least for the major consumer products, an exploitation of the fractional horse-power motor, and firms producing these motors are in an advantageous position to compete in the appliance business. This being so, it would appear easier for those already in the field to cover the entire range of products and also to embark upon making new ones.

The probable shape of the manufacturing pattern in the United Kingdom is likely to follow the American example where some firms attempt to offer an increasingly comprehensive range of products. This is likely to have an effect upon the channels of distribution. The time may not be very distant, though at present it would be inopportune, when firms offering a complete range of appliances will tend to supply exclusive dealers—or franchise holders, as they are called in the United States, where this practice has been extant for some time.

European Free Trade

Most, if not all, firms manufacturing electrical appliances must consider the likely impact of the emerging Free Trade Area in Europe upon their business. The first question which must be asked is, are we competitive. The steadily rising volume of U.K. export sales of appliances to Europe is one confirmation; about half of all electrical exports to Europe in 1956 consisted of appliances, including lighting fittings and lamps. The stability of the price structure is another. While the retail price index for all items rose by 4·4 per cent between mid-January 1956 and 1957, the price of durable household goods increased by only 1·7 per cent and those of radio, television and other appliances did not rise at all. Since purchase tax is not chargeable on exports, manufacturers' final prices over a period give a good indication of relative competitiveness again in terms of price

* Head of the Economic and Marketing Research Unit of the General Electric Co., Ltd.

Index of retail prices of electrical appliances† compared with wholesale prices of materials in the electrical machinery industry in 1949–50, 1955 and 1956

Appliance	1949/50	1955	1956	% Change 1949/50–1956
	£ s d	£ s d	£ s d	
Cooker	22 14 0	27 17 0	28 10 0	+ 25·6
	28 10 0	39 18 0	39 10 0	+ 40·0
Iron (5·5 lb) ..	1 7 4	1 12 6	1 12 6	+ 18·9
Kettle (3 pints) ..	2 6 4	2 19 6	2 19 6	+ 28·4
	2 17 8	4 2 6	4 2 6	+ 43·1
Refrigerator (5·3 cu ft)	85 0 0	75 13 3	75 13 3	− 11·0
Vacuum cleaner..	12 0 0	15 15 0	16 16 0	+ 31·3
	%	%	%	%
Materials used in the electrical machinery industry ..	100·0	185·7	190·0	+ 90·0

† Prices of electrical appliances do not include purchase tax.

stability. This can be seen by comparing the price movements of a fairly representative range of appliances, with wholesale prices of selected materials used in the electrical machinery industry.

Prices of appliances in general in the last six years have risen by less than half those of raw materials used in the electrical machinery industry. This would indicate that part of the increase in costs of manufacture has not been passed on to the consumer. In fact the reduction in the price of domestic refrigerators is a good indication of how prices react to higher output.

The second question is: "Can we expand sales in the European markets even further?" Inasmuch as customs duties affect disproportionately the final retail price, their gradual elimination could, conceivably, bring electrical appliances within the reach of a wider market. Bearing in mind that the United Kingdom appliance industry increased its exports to all countries by 65 per cent between 1950 and 1956, the prospects of a further increase are propitious, providing the home market is not restricted.

More Competition

The third question is: "What about European competition?" We know that some European countries have efficient and extensive facilities for the production of electrical appliances. The three most important European producers are Britain, Western Germany and Holland. There is little doubt that the principal contenders for supremacy in electrical appliance sales in Europe are Britain and Germany, and Germany appears to have expanded more rapidly in the export field in recent years. In 1953 Germany's share of export trade in electrical appliances was smaller than ours, but by 1955 her share was about one-third greater. Paradoxically, Germany's imports of electrical appliances were three times as large in 1955 as Britain's. Germany's chief imports have been radio sets, washing machines and refrigerators.

The high rate of German exports indicates an increase in that country's manufacturing capacity, but this need not be very substantial. A small expansion in capacity could be devoted wholly to exports. If it is assumed that the United Kingdom, Western Germany and Holland between them possess the bulk of manufacturing capacity for electrical appliances in Europe, the auguries for this country in the export field cannot be viewed with dismay. Furthermore, Holland is a specialist producer, concentrating on lamps, valves and radio equipment.

This implies that in other appliances Britain and Germany have a proportionately larger productive capacity. Also, Britain has a more diversified range of appliances to offer than Germany which should put this country at an additional, if temporary, advantage. United Kingdom manufacturers are also more likely to experiment with the introduction of new lines. The moral—both for home and for export sales—is that opportunities for diversified producers are likely to be greater.

News from India

FROM OUR NEW DELHI CORRESPONDENT

IT has now been announced that the Railway Board has decided to adopt the a.c. system for all main line electrification. This decision has been taken on the basis of the recommendations of a team of French railway engineers which, headed by M. Nouvion, chief engineer, French Railways, went to India last year at the request of the Indian Government. After studying the railway system in India, the mission came to the conclusion that it was almost impossible to increase the tonnage and speed of the trains without electrification. At present, there are only 240 route miles of electrified track in the country operating on a contact wire at 1,500 V d.c. In the second five-year plan, it is proposed to add about 1,100 miles of track, mainly in the Calcutta suburban sections, and the thick industrial and commercial belts near Bombay and Madras. The electric power supply will be obtained from the existing power grids at 132 or 110 kV and stepped down to the operating voltage of 25 kV. The estimated cost of the schemes is about Rs.104 crores, involving foreign exchange of the order of Rs.65 crores. The schemes are expected to be completed in about four years' time.

The expenditure on electrification is only about 10 per cent of the total outlay on railway development in India. The railway plan provides for the doubling of 1,607 miles of track, conversion of 265 miles of metre gauge lines into broad gauge, "dieselisation" over 1,293 miles, construction of 842 miles of new lines, the purchase of 2,258 locomotives and about 110,000 wagons and 12,000 coaches. Of the total outlay of Rs.1,125 crores during the next five years, about Rs.430 crores will be required for purchases abroad, mainly for special types of stock like electric and diesel locomotives and special wagons. It has been estimated that in one way or another the expenditure on electrical machinery and goods including machinery for construction would amount to roughly 25 to 30 per cent of the total outlay.

Because of the size of the industrial development proposed for the country during the next few years, the railways will continue to be under tremendous pressure for the expansion of their capacity and more efficient utilisation of their resources. One has to view the railway plans, as also the plans for other industries, against the background of tremendous industrial activity in India. Steel production is to go up from the present 1,250,000 tons to about 5,000,000 tons in less than five years from now; cement from the present 5,000,000 tons to 16 million tons; fertilisers from 85,000 tons to 370,000 tons and sulphuric acid from 170,000 tons to 470,000 tons. On an average the index of industrial production will be more or less trebled by the end of the plan.

The railways have to meet this increased economic activity as expeditiously and economically as possible, but despite the fact that the outlay on transport including railways is just under 30 per cent of the total expenditure on the plan as a whole, it has been discovered that there will still be a sizable shortfall in the capacity of the railways to handle the increased traffic and it is feared that this may jeopardise the success of the plan itself. The World Bank, which sent out a mission recently to study this problem, has also pointed this out to the authorities concerned. The World Bank has been approached for a loan and an Indian mission is at present in Washington trying to persuade the Bank to sanction it. A figure of 100 million dollars has been mentioned but this has not been confirmed.

New Laboratories at Sheffield University

By DOUGLAS HARRISON, M.Eng., Ph.D., A.M.I.E.E.

WHEN the Sheffield University Departments of Civil and Mechanical Engineering had been largely transferred to the new Engineering Building, which was officially opened in 1955, space was left within the older building for a substantial expansion of the Department of Electrical Engineering, the professor of which is Mr. A. L. Cullen, Ph.D., A.M.I.E.E. During 1956 to 1957 the rooms vacated by the other departments and the existing electrical laboratories have been completely redesigned and re-equipped. These extensions were officially inaugurated on Friday last, 28th June, by Sir Harold Bishop, B.B.C. Director of Engineering.

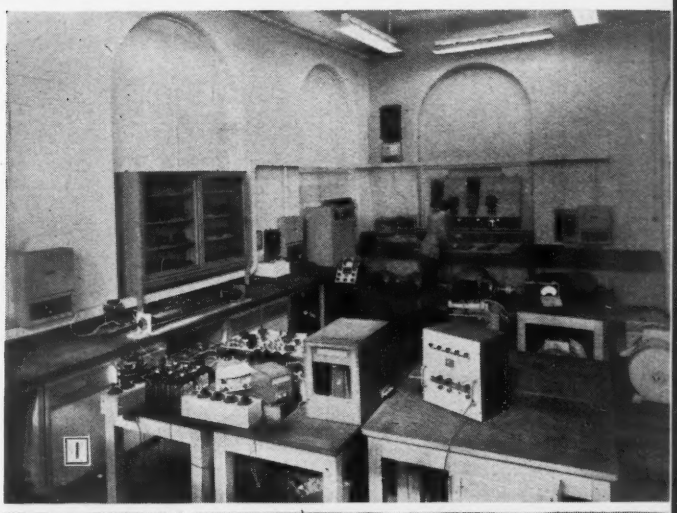
There are now ten separate laboratories, with a floor space about twice that occupied by the Department before. Four of these laboratories are used for heavy-current teaching and research, three mainly for machines and the other for transformers, rectifiers and other static apparatus. A very comprehensive range of machines and other apparatus is available. A monorail and a small mobile gantry provide for the movement of heavy gear between laboratories on the lower ground floor, and to and from the outside. However, many of the smaller machine sets are mounted on wheels, which gives the greatest flexibility in use and permits a larger ratio of student numbers to floor area.

There are two large laboratories used mainly for undergraduate experiments in measurements and electronics, and a photometric laboratory with photometric bench, integrating cube and other illumination test apparatus. In the standards laboratory a complete inner room has been built of aluminium-faced plywood to form a complete metal screen, with properly filtered incoming supplies. This is used for precision measurements, and is equipped with d.c. and a.c. potentiometers, bridges, standards of resistance, inductance and capacitance and so on.

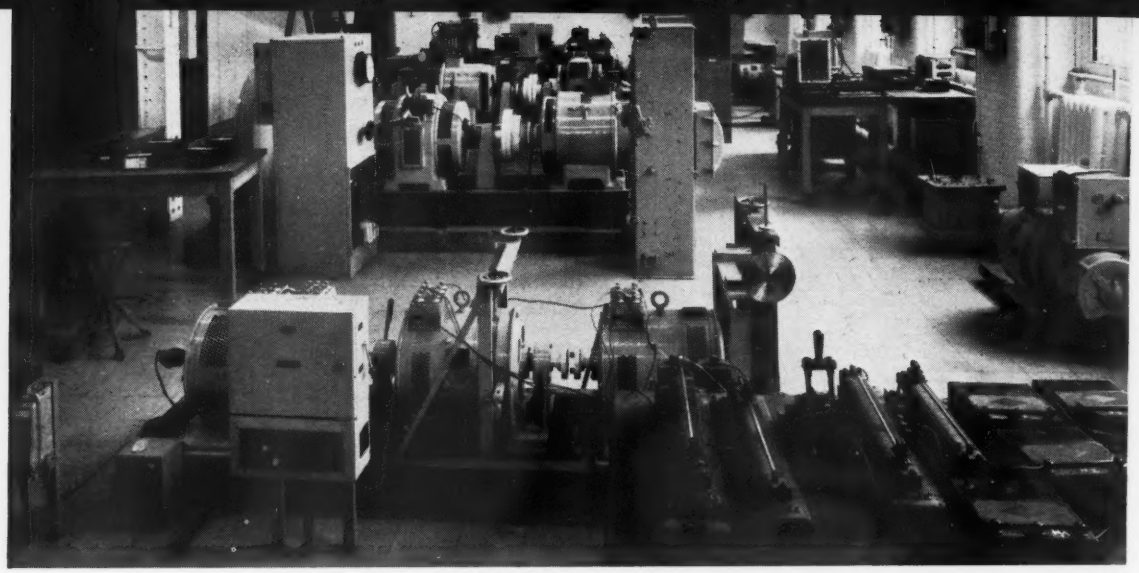
The electronics and microwave laboratories are used entirely for research. The former contains high-vacuum equipment generously given to the Department by the Metropolitan-Vickers Electrical Co., Ltd., while the latter is equipped with oscillators, waveguide test benches and other apparatus for experimental work in the microwave band from about 8 mm to 11 cm wavelength.

The Department also has two workshops and a battery room housing the 200 V, 900 Ah, centre-tapped, lead-acid battery which supplies the three-wire d.c. system throughout the Department. The charging equipment consists of a motor-generator, a booster-balancer set and metal rectifiers.

The electric power supplies in the laboratories have been designed to give the greatest possible flexibility consistent with reliability and safety. The light current laboratories are generously provided with three-pin, 13 A switch sockets for 240 V single-phase a.c. and with 5 A and 15 A switch sockets for 200 V d.c. These supplies are adequate for normal purposes in these rooms, but each laboratory is also equipped with at least one



1. Edgar Allen Research Laboratory: research is in progress on the characteristics of magnetic materials. 2. Small machines laboratory: note the distribution cubicle under the staircase and the two central terminal pillars, each of which incorporates two independent experimental boards. 3. Electrical power laboratory, used for tests on static power apparatus such as transformers and rectifiers. Experimental terminal boards are visible on the ends of the benches and the distribution cubicle is seen in the background



Large machines laboratory: experimental terminal boards are seen, one in the left foreground and others on the walls. The machines in the middle distance are alternator sets with their control cubicles beside them

four-wire, 30 A, " experimental " supply fed from a socket on the main cubicle in the large machines laboratory. This provides for interconnection between laboratories and for special supplies if required. The 240 V a.c. supply for these laboratories is taken from a 415 V, three-phase and neutral, ring main which has been installed for the general supply to the whole building. The d.c. comes from the battery already mentioned.

In the four heavy-current laboratories a rather special system of distribution is used. The normal supplies available in these laboratories are:—415 V, three-phase and neutral; 230 V, three-phase and neutral; and 200 V, three-wire d.c. (100/0/100) from the battery. With the exception of the Edgar Allen Research Laboratory, which has separate 415 V and d.c. supplies, the main control for all the supplies to these laboratories is by isolators and splitters situated within the main cubicle in the large machines laboratory. Adjacent to this is the 415/230 V, three-phase, 100 kVA, auto-transformer, which also has 110 V tappings taken to a socket on the cubicle.

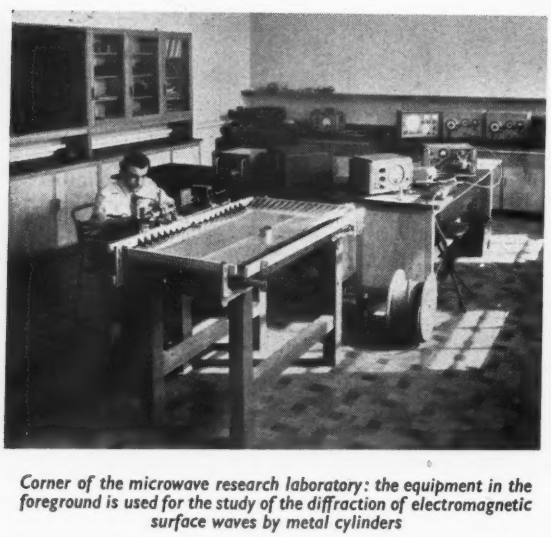
The three supplies are not fed direct to the machines, except to a few of the largest, but are connected to a special cubicle in each laboratory. Each incoming supply to these is controlled by a fuse-switch, feeding a number of four-pole sockets all separately fused. Four-core flexibles are used, with a shielded plug on each end, to connect these sockets to others which are connected to outlet or " experimental " points distributed round the laboratory. In addition, each cubicle has two sockets connected to corresponding ones on the main cubicle in the large machines laboratory, where any inter-laboratory connection can be made.

At the " experimental " points the four cables terminate in switch-fuses connected to insulated terminals (four colours). On walls or fixed benches, the switch-fuse and terminals are mounted in an enamelled steel box, but where there are no fixed benches, as in some laboratories, floor-mounting pillars are used to give supplies in the middle of the room. The boxes and pillars have doors with locks for access to fuses, and each is provided with an independent 13 A switch-socket for 240 V a.c. supplies to oscilloscopes, portable lamps and other test apparatus.

The connections have been made systematically, so that not only is the phase sequence correct at every set of terminals, but the red terminal is always connected to the " red " line, and when interconnection is made between experimental points, the two sets of terminals are connected in the proper order. The cubicle in the large machines laboratory serves its own system within that laboratory as well as acting as the focal point to which all the others are connected. It has 60 A plugs and sockets, and so has the Edgar Allen Research Laboratory. The others have 30 A circuits. Wherever possible the wiring is carried in surface trunking.

With the exception of the photometry and standards laboratories, which have tungsten lighting, the laboratories are very adequately lit by fluorescent lamps. These are switched in groups of three or six, fed from three phases, with three-pole switches, so eliminating stroboscopic effects and reducing the number of wall switches.

The university surveyor was responsible for the design and supervision of the alterations and additions, the electrical consultants being Hoare, Lea & Partners. The main buildings and fittings contractors were Geo. Longden & Son, Ltd., and the electrical contractors were the Yorkshire Electricity Board. The special experimental panels and cubicles were designed and manufactured by Field & Grant, Ltd. (Birmingham).



Corner of the microwave research laboratory: the equipment in the foreground is used for the study of the diffraction of electromagnetic surface waves by metal cylinders

NEW ELECTRICAL EQUIPMENT

Soldering of Stainless Steels

A solder paint for speedy hot tinning of stainless steel has been developed by the research laboratories of PERDECK SOLDER PRODUCTS, LTD., Abbey Mills, Waltham Abbey, Essex. It is known as "Epatam 3311" Code PLF.73/11. This new product, which possesses high degreasing and penetration properties, also effectively tins through iron welding scales, rust and grease, depositing a bright tinning. One of the features of this new paint is the simplicity of application. The solder paint is merely painted on straight from the tin, undiluted, followed by heating by any convenient method to normal soldering temperature.

Plastic Cable Clips

A neat and speedy means of fixing cable has been developed by HIATT & Co., LTD., Baltimore Road, Great Barr, Birmingham, 22B, in the form of a plastic cable clip. The clip is designed to "push fit" with only light pressure on to the cable before erecting in any desired position. The carbon steel pin, part of the unit, will drive into wood, plaster or mortar. The clips are supplied in 5 and 7 mm sizes at present and a 4 mm size will be available later.

Resistance and Capacitance Comparison Bridge

Intended for the measurement of resistance and capacitance or for the comparison of resistors, capacitors or inductors against known standards, an instrument manufactured by NASH & THOMPSON, LTD., Oakcroft Road, Chessington, Surrey, employs the principle of the Wheatstone bridge in resistance measurement and comparison and the de Sauty bridge in capacitor measurement and comparison. In both instances the measurement is made at mains frequency with an applied potential of 18 V.

Both bridge circuits are rendered extremely sensitive by virtue of the novel twin neon device used to indicate the balance point. To obtain a reading the balancing potentiometer carrying the scale cursor is rotated clockwise or anti-clockwise in the direction of the lighted neon lamp. As the cursor approaches the value of the component under test this neon lamp will dim until, at the final balance point, it goes out altogether. On passing through this point the other neon lamp will ignite and it is possible to measure the true value of the component extremely accurately by adjusting the cursor position until both indicators are either completely extinguished or just glowing equally.

The balancing potentiometer is wire wound and cam corrected and has a guaranteed linearity of within 0·1 per cent, permitting the use of a preprinted metal scale on the panel which is practically immune to damage.

Dustex Collector

The Mancuna-Dustex two-stage dust collector, manufactured by MANCUNA ENGINEERING, LTD., Denton, Manchester, is designed to clean the CO_2 gas circulating through the reactor heat exchanger of an atomic power station. It has no moving parts and no replacement cells, and can therefore be enclosed in a permanent biological shield.

This unit is capable of handling a gas volume of 20 lb/sec of CO_2 gas at 180-200 deg C at 140-160 lb/sq in. The collecting cells consist of 4½in diameter cyclones of machined and polished cast meehanite in two stages. The first stage at low pressure removes the dust down to approximately 10 microns and the second high pressure stage down to about 4 microns, and a high percentage of dust below 4 microns. The pressure vessel is 2ft 8in in diameter and the overall height is 8ft 3in.

Infra-Red Projector

A new narrow-mouth projector has been introduced by the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester, 17, to meet the need for a high intensity heat source for processing narrow strips or bands of material in conjunction with vibratory conveyors, where the standard unit would be too wide. It can also be used for stoving paint and drying lacquer on small articles such as castors, toys, fashion jewellery, etc., particularly where automatic spraying is employed with single line conveyors. Another important use is heating the edges of thick plastic conveyor belting to soften or cure the edge capping.

Each projector consists of two Inconel sheathed heating elements backed by a Brytal anodised aluminium reflector in a perforated sheet metal cover finished in stoved black enamel. Internal wiring is complete to a terminal box at one end of the unit, fitted with a ¾in diameter conduit entry. The width of the projector is 5⅛in. The units are available in the following sizes for single-phase operation: 2ft long 1·2 kW max., 3ft long 1·8 kW max., 4ft long 2·4 kW max., 5ft long 3 kW max. and 6ft long 3·6 kW max.

Spin Dryers

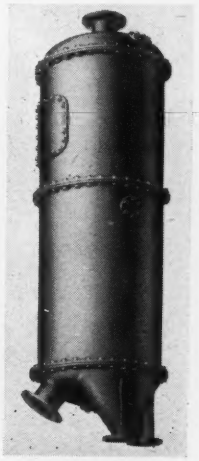
The latest addition to the range of domestic appliances produced by the KENWOOD MANUFACTURING CO., LTD., Woking, Surrey, is the "Sun-dry" spin dryer available in two sizes, the K1 (6-7 lb dry clothes capacity) and the K2 (8-9 lb). Both models are claimed to be non-rusting and less liable to chipping as they are finished in porcelain vitreous enamel throughout.

Whereas many spin dryers are belt-driven, the "Sun-dry" is fitted with direct drive induction type motor, which means that clothes can be loaded straight in, layer by layer. There is no need to leave a central gap. It is light and easy to handle, the respective weights being 36 and 56 lb, and as the direct drive motor means absence of torque, no heavy base to the machine is required. Cupped rubber feet grip the floor surface.

Both machines are 14in in diameter and their heights are 20in (K1) and 23in (K2). A simple hand brake with automatic cut-out is fitted. The prices are £24 16s 3d (K1) and £28 16s 7d (K2), plus £10 17s 9d and £12 12s 11d, respectively, for purchase tax in the United Kingdom.

Above: Metrovick narrow-mouth infra-red projector

Centre: Kenwood "Sun-dry" spin dryer



Right: Mancuna-Dustex two-stage dust collector

Jodrell Bank Radio Telescope

THE 250ft diameter radio telescope at Jodrell Bank, Cheshire, which is the largest steerable one in the world, is now nearing completion. It is being built for the University of Manchester by Husband & Co., of Sheffield. All of the electrical machines, control gear and reduction gear equipment providing the motive power for the telescope are being manufactured, supplied and erected by the Brush Electrical Engineering Co., Ltd. In addition, this company is responsible for the development and supply of the electronic equipment which converts the telescope controller's requirements into the movement control of the driving motors. Alfred Wiseman & Co., Ltd., supplied and assembled the gear equipment, while the Watford Electric & Manufacturing Co., Ltd., and Dewhurst & Partner, Ltd., provided some of the motor control gear.

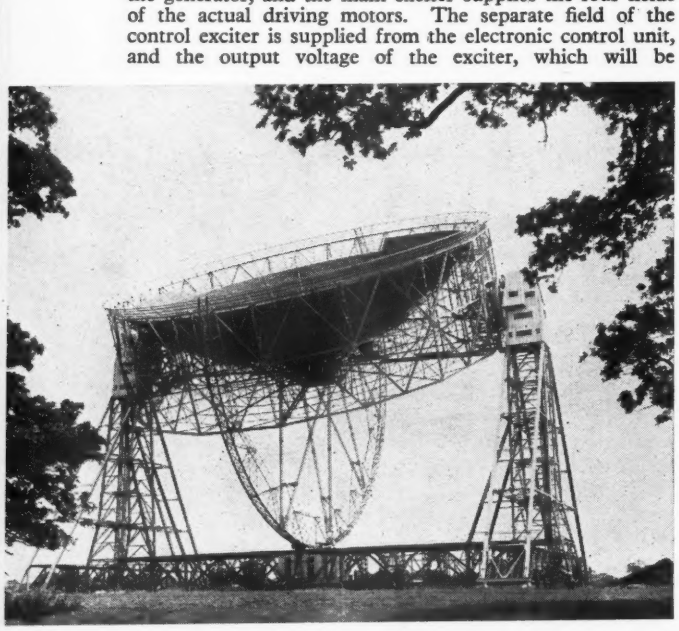
The overall system controlling the telescope is required to provide for tracking, scanning and traversing motions; tracking and scanning must be accurate to within ±12 min of arc.

Instruction signals are received from a computer, which defines the position to which the telescope is required to be turned in both azimuth and elevation. Electronic equipment determines from this signal the speed at which the driving motors are to run, and also when to bring the telescope to rest in the required position.

The control equipment can be considered as two identical sets of equipment: one for driving the telescope in azimuth (turning the whole structure round on its bogies), and the other for driving it in elevation (movement of the reflector bowl about its horizontal axis). Each movement is actuated by means of four variable speed d.c. motors, the speed range being from 10 to 1,000 r.p.m. by Ward-Leonard voltage control, and from 1,000 to 1,500 r.p.m. by weakening of the motor field. The motors then drive through a series of high ratio reduction gear trains in order to produce the very fine movement of control.

The four motors of each drive are connected electrically in series, and the power is supplied from a 175 kW d.c. generator. The control exciter output supplies the field of the generator, and the main exciter supplies the four fields of the actual driving motors. The separate field of the control exciter is supplied from the electronic control unit, and the output voltage of the exciter, which will be dependent on the strength of the signal, is applied to the generator field. This will, in turn, govern the generator output voltage and the speed at which the driving motors will run. The field weakening control at high speeds is carried out by operation of shunt field regulators under automatic control.

The power supply for the telescope is provided by a Brush/Mirrlees generating set, having a 400/440 V three-phase 50 c/s output. The d.c. supply for the motors is provided by an a.c. motor driven generator.



General view of the Jodrell Bank radio telescope now nearing completion

Road Heating and Lighting

In his report for 1956* the Director of Road Research, Department of Scientific and Industrial Research (Dr. W. H. Glanville), refers to the possibility of heating roads electrically at dangerous intersections, hills and bends to prevent ice formation. Preliminary trials in the Road Research Laboratory grounds showed that from 1 to 6 W/sq ft was sufficient to achieve this on two types of road surface during the winter of 1955-56.

One section of road consisted of two courses of asphalt on a stone base, while the other was a concrete slab. In both cases the surface was heated by a grid of expanded metal placed 1½in below the upper surface and supplied with electricity at low voltage from a transformer. A further experiment was to be made during the winter of 1956-57 on a "trafficked" road using several arrangements of heating grid, one of which consisted of resistive cable fed at full mains voltage to eliminate, if possible, the capital cost of a transformer. Details are being kept of the running costs to see whether the methods are economical.

Dealing with the lighting of national roads outside built-up areas, the Director says that there are many stretches of unlighted road near towns which carry large amounts of fast traffic at night. In such circumstances it might be thought uneconomic to install Group A lighting because there are few pedestrians, but the toll of night accidents suggests that some form of street lighting would be useful to help drivers to see other vehicles and the road direction.

With this object in view the Laboratory has experimented with various types of low-cost lighting schemes, the most successful of which is undergoing a full-scale trial at the Colnbrook By-pass (A.4) near Slough, Bucks. Cut-off lanterns at three times the normal spacing provide a series of patches of light which serve to show the general direction of the road and also provide a series of illuminated bands against which other vehicles can be seen. Dark patches remain in and between the pools of light underneath the lamps and in order to obtain some illumination there it is proposed that motorists should be asked to use their dipped headlamps; it should never be necessary to use full headlights. Such an arrangement uses a third of the lamps used in conventional lighting and costs between a third and half as much to install.

* "Road Research, 1956." H.M. Stationery Office, 5s 6d.

Motor Show

The Society of Motor Manufacturers and Traders announces that the annual London Motor Show will take place at Earls Court from 16th to 26th October. The opening ceremony will be performed by the Prime Minister.

SERIES POWER CAPACITORS

Their Application in Electrically Short Overhead Lines

By C. W. NIXON, B.Sc.(Eng.), A.M.I.E.E.*

SERIES capacitors are usually thought of in connection with long, e.h.v. lines where their function is to improve stability by reducing the effect of line reactance on the angular displacement of the voltage. In such applications it is not as a rule desirable or economic to compensate the line reactance by more than about 50 per cent. A good case can also be made for the use of series capacitors in electrically short lines, where they can operate as very efficient, highly automatic voltage regulators. When used in this way they can be designed to compensate the line reactance by 200 per cent or more. However, it should be realised that in such cases some of the published formulæ relating to series capacitors cannot be used, as they stand, with any accuracy for performance calculations.

For example, the commonly accepted voltage drop formula for a short three-phase overhead line is

$$e = \sqrt{3}\, I\,(R_L\cos\phi + X_L\sin\phi) \quad \ldots\ldots\ldots\ldots\ldots(1)$$

When this is modified to take care of the inclusion of a series capacitor in the line it becomes

$$e = \sqrt{3}\, I\,(R_L\cos\phi + (X_L - X_C)\sin\phi) \quad \ldots\ldots(2)$$

In the above equations

e = voltage drop between lines
R_L = total line resistance
X_L = total line reactance
X_C = reactance of series capacitor
I = line current.

As will be shown later, equation (2) gives a result sufficiently accurate for practical purposes, only if the line compensation does not exceed about 80 per cent. Above this figure inaccuracy will be introduced, which will increase rapidly as the degree of compensation is increased. Thus for calculations involving over-compensation of short lines, it is necessary to use the exact equation for a short line, viz:

$$E_S^2 = E_R^2 + 2E_R I(R_L\cos\phi + X_L\sin\phi) + I^2(X_L^2 + R_L^2)$$

which can be written

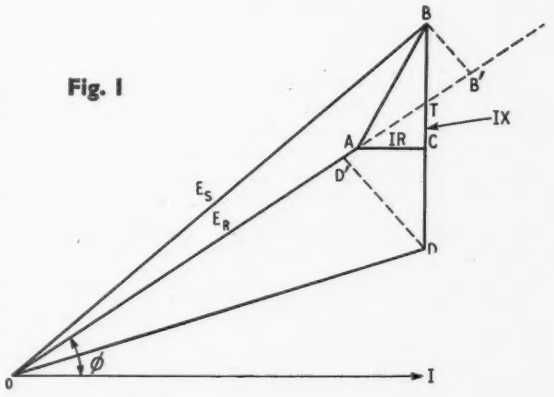
$$E_S = E_R\Big[(1 + \frac{I}{E_R}R_L\cos\phi + \frac{I}{E_R}X_L\sin\phi)^2 + \frac{I^2}{E_R^2}(R_L\sin\phi - X_L\cos\phi)^2\Big]^{\frac{1}{2}} \quad \ldots\ldots(3)$$

Here E_S is the sending voltage between line and neutral, and E_R is the receiving voltage. By substituting $X_L - X_C$ for X_L in equation (3), we have the modified version for use where a series capacitor is included in the line.

The reason for the inaccuracy of equation (2) when used for a line which is more than 80 per cent compensated can be readily demonstrated. Equation (1) is derived from equation (3) by neglecting the terms of the second order, i.e., those with E_R^2 in the denominator. It can be seen from the vector diagram in Fig. 1 that this is the same thing as assuming that the magnitude of the sending end voltage vector OB is the same as the magnitude of its projection on to the receiving end voltage vector OA; i.e., that OB = OB′ which is equal to OA + AB′. Obviously AB′ is equal to IR cos ϕ + IX sin ϕ.

This does not introduce a significant error so long as the angular displacement of the receiving end voltage is small when compared with the sending end voltage (angle BOA). As compensation is introduced, line reactance will be decreased and B will move towards C. At a compensation of the order of 50 per cent, B will be at T where E_S is coincident with E_R and the angular displacement is zero. Under this condition no approximation occurs when equation (2) is employed. As point B moves beyond point T, i.e., compensation increases above about 50 per cent, angular displacement of voltage again occurs, but in the opposite direction and it increases rapidly with the degree of compensation. At 80 per cent compensation, as stated above, the angular displacement is of the same order as it is in an uncompensated line. At 200 per cent compensation, when B has moved to D (Fig. 1) it has become considerable and the magnitude of the sending voltage vector OD does not approximate closely to its projection on the receiving voltage vector OA.

Fig. 1



Let us take for example a 33 kV line, 50 miles long, having a 0·1 sq in conductor and let us calculate the voltage drop on this line for three different loads, namely 100, 150 and 200 A at 0·8 power factor and assuming varying degrees of compensation up to 300 per cent. The results obtained using both equation (2) and equation (3) are shown graphically in Fig. 2.

It will be seen that according to the approximate formula of equation (2) the voltage drop decreases directly as the increase in degree of compensation and having passed through zero becomes a voltage rise which increases directly and indefinitely with increase in degree of compensation. The results obtained by the exact formula of equation (3) agree well with those of the approximate formula up to about 80 per cent compensation, but beyond that diverge very markedly and show a reduced improvement in voltage as compared with the latter.

It will be found that there is an optimum degree of compensation as far as voltage is concerned. This is apparent in the curve for 200 A. It will be seen that it passes through a minimum at about 285 per cent compensation. The reactance of the line is 31·26 ohms and

* British Insulated Callender's Cables, Ltd.

this has been compensated 2·85 times. Thus the excess capacitance is $1{\cdot}85 \times 31{\cdot}26 = 57{\cdot}8$ ohms per phase. At 200 A this represents 6,900 kVAr which is the amount required to compensate the load reactance, or in other words to raise the power factor of the load of 200 A at 0·8 p.f. to unity.

This condition is readily seen from the vector diagram of Fig. 1. As compensation is increased, the sending voltage vector OD swings further away from the receiving voltage vector OA and approaches the current vector OI. When OD becomes coincident with OI we have the condition referred to above. The sending power factor angle DOI is zero, i.e., sending power factor is unity and all reactance, both line and load, has been compensated. Moreover, OD is at right angles to DC and is therefore at a minimum. Any further compensation from this condition would give rise to a leading sending power factor and an increase in voltage drop.

It can be said therefore that compensation by means of a series capacitor beyond the degree necessary to counteract the line and load reactance will lead to an increase, and not a decrease, in voltage drop. It is also evident that the use of the approximate but widely employed formula can lead to serious errors when over-compensation of a line is involved.

Turning to another formula, a number of authors of papers on series capacitors use the formula:

$$P_c = \frac{k.P}{1-k}$$

where P is the transmission capacity of a line, P_c is the increase in transmission capacity of the line when compensated to a degree k, and k is $\frac{X_c}{X_L}$. This formula, like that of equation (1) is derived by making certain approximations. In its full form it is:

$$P_c = \frac{k.P}{\sqrt{\left(\frac{R}{X_L}\right)^2 + (1-k)^2}}$$

If R is small compared with X_L and if k is not too close to unity, it is a fair approximation to neglect $\left(\frac{R}{X_L}\right)^2$. This

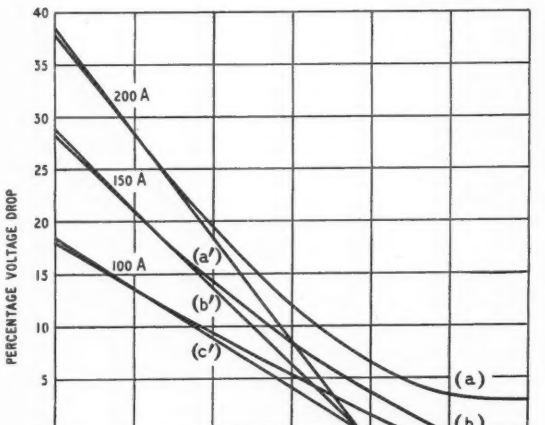


Fig. 2

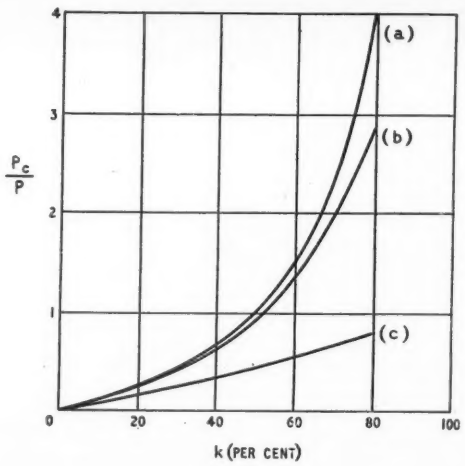


Fig. 3

then gives the previously mentioned formula. In using this formula, however, the approximations made must be borne in mind. Firstly, its use should be confined to cases where R is small compared with X_L and this circumstance is generally associated with lines at the highest voltages. Secondly, the degree of compensation must be appreciably less than unity.

In Fig. 3 three curves of $\frac{P_c}{P}$ are plotted against k. Curve (a) is drawn to the approximate formula. Curve (b) is drawn to the full formula assuming a $\frac{R}{X}$ ratio of approximately 0·2. (This would be valid for a 0·4 sq in, 220 kV line.) Curve (c) is drawn for a $\frac{R}{X}$ ratio of unity such as is common on medium and low voltage distribution lines. It will be noticed that curves (a) and (b) do not show much discrepancy as long as k is not greater than about 0·6. Curve (c), however, differs widely from (a) at all compensations of practical importance.

Thus we conclude that it is safe to use the approximate formula in connection with electrically long lines at a very high voltage where, as has been stated earlier, compensation rarely exceeds 50 per cent (i.e., k is not greater than 0·5), but it cannot be used at all in cases where k approaches unity or higher and that therefore it cannot be employed in connection with highly compensated medium voltage lines.

The author wishes to express his thanks to British Insulated Callender's Cables, Ltd., for permission to publish this article.

European Free Trade

The Treasury has published a 32-page booklet, "Freer Trade in Europe" (H.M. Stationery Office, price 2s), which is designed to enable the reader to understand what is going on in the negotiations on the proposed European Free Trade Area. It gives many relevant facts and statistics, illustrated by diagrams, about the economies of the area and of the constituent countries as well as information about Russia and the United States. One useful section shows the markets of the O.E.E.C. countries for a number of the leading classes of commodities, including electrical machinery and apparatus.

International Power Sources

PAPERS PRESENTED AT THE WORLD POWER CONFERENCE, BELGRADE

IN addition to the discussions at the recent Belgrade meeting of the World Power Conference on papers relating to energy supply against the general economic background of under-developed countries (reported in the *Electrical Review* of 5th July) there were several sections dealing more specifically with technical aspects. The first of these concerned the multi-purpose utilisation of water. Professor M. Pecinar named irrigation as the most serious large-scale competitor of hydro-electric power for priority of attention. Hydro-electric generation generally required storage of about one-third of the total discharge unless integrated with comprehensive supply systems.

Integration of water power in a predominantly thermal system was shown by Mr. J. Henderson (South of Scotland Electricity Board) to lower the operating costs of the thermal plant; the power output and load factor of storage schemes were chosen to give this result. Generally in that case water power should cope with the peak load, using thermal plant according to merit to supply base and intermediate loads. It was shown that the appropriate load factor for any hydro-electric station could be mathematically determined for any month of the year and also for future years, subject to any alteration in circumstance in the meantime.

Reconciliation between the diverse claims of irrigation, flood control and power supply was worked out by Mr. G. M. Binnie (Binnie, Deacon & Gourley) in connection with the Dokan Dam scheme on the River Tigris. Although waste gas from the oilfields (as for the 40 MW station now being built near Kirkuk) would probably continue to be the prime fuel for many years in Iraq, provision was being made at the dam for later construction of a 40 MW hydro-electric station.

Other papers included a reference to the expectation

Mr. J. Henderson

Mr. G. M. Binnie

Mr. C. A. Masterman

that within twenty years hydro-electric resources in Spain (which had only meagre fuel reserves) would all be harnessed. After that time nuclear power would be necessary. Experiments in artificial precipitation of rain by silver iodide, carried out in the Pyrenees, were regarded as indicative of great possibilities. The economies possible by pumped storage were shown to have been considerably enhanced on the Continent during the past half century through the increased efficiency of turbines and through a reduction by 50 per cent of the material required for pipe lines. Common usage of frontier water courses was illustrated by twelve h.e. plants now in commission on the Rhine, Rhone and Dubs with a total capacity of 708 MW. The Swiss share of the plant represented 110 per cent of the MW installed in that country. Similar projects provided for a further 1,700 MW.

Papers dealing with the firing of low-grade fuels were summarised by Professor D. Velickovic (Belgrade University), who in the absence of any international terminology defined broadly their characteristics. Lignites, the youngest coals, he separated from brown coals as typically containing from 45 to 60 per cent of moisture,

Mr. C. A. Cameron Brown

Mr. H. R. J. Baigent

Mr. E. W. Golding

6 to 20 per cent mineral matter and having a calorific value of 1,000 to 2,000 k.cal/kg. Brown coals might contain up to 75 per cent of carbon and less than 30 per cent of moisture.

Experiments over seven years in the underground gasification of coal in Great Britain were described by Mr. C. A. Masterman (National Coal Board). The most promising of these, started in October of last year and based on the drilling of blind boreholes for long distances in the coal seam, was expected to maintain its initial gas quality of 900 k.cal/cu metre throughout a life of 25 years. The intention was to have a 5 MW generating plant in operation next year and a 60 MW plant by 1961. The gas cost was estimated to be about half that of pithead coal for equal heat value.

Difficulties in paying for equipment as well as for energy were pointed out by Mr. S. Han in opening an agricultural session. Many processes would lend themselves to community treatment, as was shown by Messrs. C. A. Cameron Brown (C.E.A.) and H. R. J. Baigent (Southern Electricity Board). First came the need for good domestic electrification not only in the farm house but in the homes of all farm workers. Other priorities were electric fencing, water supply and farm lighting.

A herd of ten to fifteen cows was needed to justify expenditure on electric milking, but collective milking at community centres was successful in Germany. Thermostatically controlled storage water heating was the key to maintaining cleanliness of milking utensils. Approximate electricity consumption in kWh/ton for drying grain for each 1 per cent moisture reduction was: in silo, 13 to 22; batch, 20 to 25; in sack, 15 to 20. For grass drying with a 4 h.p. axial-flow fan giving an air speed of 25 ft/min, three batches of 12 tons of hay might take, in United Kingdom weather, 14 to 21 days using 190 kWh/ton.

The case for exploitation of such locally available

energy sources as wind, solar radiation, small-scale hydro power alone or in combination in order to avoid costs of transmitting and distributing small supplies of electricity to widely scattered consumers was presented by Messrs. E. W. Golding (Electrical Research Association) and P. G. Finn-Kelcey. The total cost of generation at 500 to 1,000 kW diesel central stations (at 30 per cent load factor) was not likely to be less than 4d/kWh in under-developed countries, which would probably compete with transmission of less than 1,000 kW from a distance of more than 150 miles. Distribution charges were estimated at 1·5d to 2·4d/kWh in addition. For farms and isolated communities the cost with diesel-

Mr. P. G. Finn-Kelcey

Mr. G. B. R. Feilden

Mr. R. J. Rennie

electric sets of from 3 to 30 kW would range from about 4¼d to 5d/kWh. With wind-driven d.c. generators of up to 3 kW with electric batteries, the cost might be 6d to 1s/kWh, but when used with a.c. generators of 8 to 50 kW with an annual mean wind speed of 15 m.p.h. the specific output in kWh/annum/kW would be 2,700 and the cost 1d to 1·6d/kWh. Costs per kWh of solar radiation in tropical or sub-tropical regions employing flat-plate or concentrating collectors, were estimated at 1d to 2d for water heating distillation and space heating, at 4d to 6d for water pumping and at less than 1d for cooking and steam raising. Combustion of varied waste materials could produce energy for the equivalent of 2d to 10d/kWh.

Comparison was drawn between diesel engines and gas turbines by Mr. G. B. R. Feilden (Ruston & Hornsby), who reported that horizontal low-speed single-cylinder compression-ignition engines (3 to 300 b.h.p.), as first designed by Ackroyd Stewart in 1892, were still in demand on account of their simplicity in operation, low maintenance charges and flexibility in regard to types of fuel. These advantages sometimes offset those arising out of the low weight per horsepower, compactness and higher efficiency of more modern multi-cylinder vertical units. The latter were available from 1½ to over 3,000 b.h.p., and with direct ignition and turbo-charging in the larger sizes had fuel consumptions down to 0·34 lb/b.h.p.

Gas turbines of the simple non-recuperative open type (efficiency 14 to 17 per cent) entailed appreciably lower maintenance costs than reciprocating engines and could operate without cooling water and use a variety of fuels. The addition of heat exchangers could raise their efficiency to 25 per cent with blade renewals at up to 100,000 running hours, while 35 per cent was possible with inter-cooling and reheat, particularly in the closed cycle design. Combination with nuclear reactors in power plants of over 5 MW were considered a future possibility where prices of liquid or solid fuels were high.

As an example of electricity supplies in predominantly rural areas, Mr. R. J. Rennie, described methods employed by the South of Scotland Electricity Board. Such supplies were generally transformed from 33 kV to 11 kV in blocks of 3 to 5 MVA. All 11 kV radial feeders from a 33 kV substation were three-phase, but connections thereto were normally single-phase. The rural system was largely composed of overhead lines, and multi-gap thyrite surge divertors were installed at most 33 kV terminal poles. Protection of 11 kV feeders at primary substations was by over-current and earth leakage relays and fuses were inserted only at the connection of spur lines or of pole-mounted transformers to the main lines.

Automatic spring-reclosing of 11 kV oil circuit-breakers was employed in some 33 kV substations. Reclosure was effected after 10 sec, but three reclosures were used for weight-operated outdoor breakers. Recently several high-speed fault-current-operated breakers, giving a predetermined number of reclosures at definite time intervals prior to final lock-out, had been installed experimentally in association with slow-acting fuses on the spur lines.

For 11 kV overhead lines aluminium-silicon conductors (0·05 and 0·025 sq in copper equivalent) had recently been erected instead of copper. Mid-span joints of the cone and compressed sleeve types were used for the aluminium alloy. Pole-mounted transformers (5 to 25 kVA) fully justified the extra cost of cold-rolled grain-oriented steel cores in reduced iron losses. Polyvinyl chloride or polythene insulated and p.v.c. sheathed flat-twin cables were now being used in place of v.r.i. and t.r.s. cable for consumers' services.

In a section devoted to power for metallurgical, chemical and allied industries, it was stated that the cost of electricity in a mixed iron and steel works amounted to 10 per cent of the total costs of production, assuming a consumption of 250 to 270 kWh/ton. Over 45 per cent of the total steel was produced by electric furnaces in Sweden. For melting pig iron economic equality was obtained with electricity from water power when the price of one kg of coal was five to six times as great as the price per kWh.

Information from a number of countries on nuclear reactor progress will be dealt with in a later article.

Australian Electrical News

OUR Australian Correspondent reports that the demand for electrical machinery, cables and apparatus is to-day a little above the level of that of a year ago, but competition in the industry is extremely keen. The electric motor section of the industry, however, has not improved its position, but in general it is operating at reasonable levels. Output of fractional h.p. motors, which represents about 90 per cent of total production by number (though less by value), has contracted, especially in New South Wales. Production of units over 50 h.p. rating, on the other hand, has increased by 25 per cent. Overall demand is about 15 per cent down, and fall in imports through import licence restrictions has been less than the fall in demand.

Prospects in the transformer field are encouraging. Industry is well provided with orders from electricity supply authorities, although some manufacturers would welcome orders for smaller distribution transformers. Upward trend in production has been maintained, and some makers have increased output by some 15 to 20 per cent. Sales curve continues to be upward and most manufacturers have sufficient orders on hand to keep plants operating at present rates of production for from six to nine months.

Demand for power and telecommunication cables varies with the fluctuations in public works expenditure, as the market for these items is mostly from Government and municipal authorities. Production of wires and cables is expected to expand, with emphasis on the output of plastic types. The industry is hopeful of a general increase in output by the end of 1957. Demand for power supply cables has fluctuated so far as those used for domestic house construction and commercial building activities is concerned, but demand is growing for wires and cables for lighting purposes, cookers and electric appliances.

Western German Progress

Survey of Production and Foreign Trade

By R. E. KAAN, Dipl.Ing.

LAST year, German foreign trade, notwithstanding the considerable increase in domestic demand as a result of the consistently favourable economic trend, made a further advance. A considerable proportion of increased production and investments, full employment, and well-spread order books is attributable to this further growth of exports, and imports also increased. But while exports increased by £73 million between 1954 and 1956, imports rose only by £6·3 million.

Western Germany's foreign trade accounts (Tables I and 2) again reveal a persistent vigorous rise in electrical exports. On the basis of value, last year's increase amounted to 22 per cent on the comparable figure of £175 million for 1955. The biggest increases were recorded in electronic equipment and transformers (each 35 per cent), and in switchgear (32 per cent). German manufacturers were very successful in the supply of transformers, furnaces and switchgear to India. As in previous years, Continental Europe was Western Germany's main market; within Europe, the bulk of exports went to Holland. (£1=11·8 DM.)

At a time when United Kingdom manufacturers are wondering how the economic integration of Western Europe and the proposed Free Trade Zone will affect their trade with the European market, Western Germany has been conducting a vigorous and well-timed export drive in Africa, the Middle East and the Far East. German trade delegations, including officials of the Foreign and Economic Ministries, have toured India, Pakistan, Burma and Ceylon. A well-staged industrial fair at Cairo proved an outstanding success as a means of exploiting business in Egypt at a time when trade with the United Kingdom had practically come to a standstill.

Table 3, dealing with Western Germany's electrical imports, shows the growing importance of electronic equipment in foreign trade. This is the reason why Holland ranks as the principal supplier. British electrical exports to Germany last year increased slightly, and to

Table 1.—Principal Destinations of Western German Electrical Exports, 1955-56 (Thousand DM)

Principal Markets	1956	1955	Principal Markets	1956	1955	Principal Markets	1956	1955
United Kingdom	60,156	66,935	Portugal	37,367	34,672	Chile	20,033	13,462
Saar	61,157	39,690	Sweden	199,364	167,744	Colombia	38,003	29,561
Belgium/Luxembourg	167,128	124,528	Switzerland	140,121	106,686	Peru	19,439	11,917
Denmark	41,689	34,470	Spain	28,300	23,626	Venezuela	50,633	56,638
Finland	48,950	44,543	Turkey	30,081	60,943	India	64,393	51,223
France	70,057	52,806	Egypt	29,660	32,581	Pakistan	29,917	34,322
Greece	33,785	29,568	Belgian Congo	11,133	11,434	Indonesia	29,791	19,942
Eire	12,179	11,405	French Morocco	12,028	10,606	Iraq	11,162	11,473
Italy	169,681	124,116	South Africa	26,134	18,674	Iran	36,601	24,597
Yugoslavia	33,939	49,521	Canada	10,752	6,747	Israel	35,316	26,745
Holland	310,734	233,407	United States	94,409	45,618	Lebanon	11,155	8,665
Norway	69,579	68,015	Mexico	13,019	12,082	Saudi Arabia	11,211	10,947
Austria	116,962	99,970	Argentina	71,913	45,718	Malaya and Singapore	11,237	7,809
Poland	11,518	33,352	Brazil	20,244	33,519	Thailand	13,316	9,273
						Australia	18,238	18,429

Table 2.—Western German Exports in 1956 (1955 totals in parentheses) (Thousand DM)

Product	Value	Product	Value	Product	Value
Motors and generators up to 10 kW	66,341 (52,144)	To Argentina	1,387	To Norway	2,003
To United Kingdom	1,548	,, Colombia	2,350	,, Austria	3,679
,, Belgium	5,927	,, Afghanistan	1,915	,, Switzerland	1,587
,, France	2,624	,, India	9,570	*Household washing, wringing and drying machines*	66,702 (49,777)
,, Italy	3,204	,, Pakistan	2,497		
,, Holland	10,722	*Rectifiers*	21,650 (18,215)	To Belgium	2,149
,, Norway	4,254			,, Denmark	4,705
,, Austria	2,211	To Italy	3,026	,, Luxembourg	1,237
,, Sweden	8,112	,, Holland	2,638	,, Holland	21,482
,, Switzerland	6,166	,, Sweden	1,542	,, Norway	6,014
Ditto 10–1,000 kW	59,950 (53,641)	,, Switzerland	1,525	,, Austria	12,370
		Parts of motors, generators, convertors, transformers and rectifiers	43,462 (31,310)	,, Switzerland	10,827
To Belgium	4,184			*Fans up to 600 W*	4,784 (4,855)
,, Holland	7,545	To France	4,543		
,, Sweden	5,041	,, Holland	5,103	To Greece	442
,, Argentina	2,279	,, Sweden	3,619	,, Holland	473
,, India	3,440	,, Switzerland	6,724	,, Portugal	300
,, Iran	2,057	*Accumulators*	27,852 (24,734)	*Electric domestic appliances up to 15 kg*	12,619 (8,825)
Ditto above 1,000 kW	22,292 (28,757)	To Belgium	1,160	To Belgium	2,014
		,, Holland	1,011	,, Austria	3,758
To Finland	3,975	,, India	1,165	*Hair clippers and dry shavers*	15,855 (13,825)
,, France	1,172	,, Indonesia	2,052		
,, Norway	2,520	,, Iran	1,737	To United Kingdom	1,377
,, Sweden	1,140	*Electric power tools*	38,861 (32,878)	,, Italy	1,042
,, Colombia	1,801			,, Holland	1,439
,, Venezuela	1,586	To Belgium	2,727	,, Switzerland	1,373
Rotary convertors	7,925 (7,011)	,, France	2,195	,, United States	4,359
		,, Italy	4,171	*Ignition apparatus for vehicles*	27,422 (29,162)
To Holland	1,152	,, Holland	4,389		
,, Spain	1,303	,, Austria	3,705	To Belgium	1,504
Transformers and chokes, excluding welding transformers	63,896 (46,742)	,, Sweden	2,409	,, Denmark	1,411
		,, Switzerland	4,173	,, Italy	1,145
To Saar	3,813	*Vacuum cleaners and floor polishers*	26,750 (22,498)	,, Holland	2,165
,, Finland	2,371			,, Austria	4,605
,, Israel	4,974	To Belgium	2,996	,, Sweden	3,489
,, Holland	2,371	,, United Kingdom	1,542	,, Switzerland	1,139
,, Sweden	3,407	,, Italy	2,826	,, Australia	1,808
,, Portugal	1,571	,, Holland	4,479		

Table 2 (*continued*)

Product	Value
Electric traction equipment	83,815
	(75,723)
To United Kingdom	1,258
,, Belgium	4,471
,, Denmark	4,052
,, Finland	2,228
,, France	2,438
,, Italy	3,956
,, Holland	8,914
,, Austria	5,191
,, Sweden	17,596
,, Switzerland	3,132
Electric welding equipment and parts ...	25,062
	(21,143)
To United Kingdom	1,097
,, Belgium	1,162
,, France	1,325
,, Italy	2,716
,, Holland	2,757
,, Austria	1,263
,, Switzerland	1,795
,, Turkey	1,221
Industrial furnaces and parts	26,850
	(19,362)
To France	3,681
,, Italy	1,122
,, Holland	1,914
,, Austria	2,374
Industrial and household cookers	25,872
	(21,844)
To Saar	1,503
,, Belgium	3,006
,, Greece	2,175
,, Italy	1,395
,, Holland	2,870
,, Austria	2,244
,, Sweden	1,652
,, Switzerland	3,055
Flat irons	11,962
	(10,933)
To Holland	1,354
,, Italy	890
,, Sweden	765
,, Belgium	904
Other heating appliances, incl. elements ...	42,082
	(34,872)
To Belgium	3,817
,, Italy	2,617
,, Holland	4,870
,, Austria	3,486
,, Sweden	3,325
,, Switzerland	3,740
,, South Africa	1,046
,, Peru	1,869
X-ray apparatus, tubes and components ...	58,873
	(48,628)
To Belgium	1,599
,, Denmark	1,614
,, Finland	1,884
,, Greece	1,332
,, Italy	3,388
,, Holland	3,199
,, Norway	1,067
,, Austria	1,296
,, Sweden	3,170
,, Switzerland	2,219
,, Spain	1,432
,, South Africa	1,359
,, United States...	1,637
,, China	1,405
,, India	1,948
,, Japan	1,055
Electro-medical apparatus	19,817
	(18,571)
To Italy	1,824
,, Holland	1,795
,, Austria	1,094
,, Switzerland	1,615
,, Colombia	1,619
Telephone apparatus	111,310
	(86,671)
To Saar	3,973
,, Finland	7,845
,, Italy	16,635
,, Holland	4,034
,, Argentina	33,029
,, Venezuela	4,557
,, Iran	5,665
,, Pakistan	5,485
Telegraph apparatus	33,485
	(22,749)
To Denmark	1,758
,, Holland	2,257
,, Austria	2,506
,, Switzerland	2,048
,, Colombia	2,967
Microphones, amplifiers and loudspeakers ...	12,693
	(8,726)
To United Kingdom	1,305
,, Holland	1,430
,, Switzerland	1,034
,, United States...	1,209
Radio transmitting and receiving equipment	387,785
	(289,373)
To Belgium	27,684
,, Italy	35,979
,, Holland	59,537
To Sweden	28,881
,, Switzerland	28,442
,, United States...	38,936
,, Colombia	4,759
,, Venezuela	5,901
,, Iran	6,012
,, Malaya	5,514
,, Thailand	4,609
Electric lamps and signalling and safety apparatus	15,899
	(9,228)
To Saar	1,142
,, Belgium	1,165
,, Luxembourg	1,715
,, Holland	1,074
,, Sweden	1,674
,, Switzerland	1,156
Condensers and capacitors	21,710
	(18,396)
To Italy	2,773
,, Holland	4,107
,, Sweden	1,031
,, Switzerland	1,622
H.v. and l.v. switchgear and switchboards ...	123,408
	(94,375)
To Saar	6,927
,, Belgium	8,393
,, Finland	4,780
,, Italy	7,162
,, Yugoslavia	4,472
,, Holland	11,205
,, Austria	6,751
,, Sweden	7,145
,, Switzerland	3,142
,, Spain	2,897
,, Turkey	3,370
,, Argentina	2,710
,, Venezuela	5,746
,, India	5,480
,, Israel	6,688
Installation material up to 750 V	73,454
	(68,360)
To Belgium	4,612
,, Italy	3,131
,, Holland	17,545
,, Norway	5,116
,, Sweden	10,512
Control and regulating apparatus	46,607
	(34,507)
To France	3,169
,, Italy	4,175
,, Holland	6,634
,, Sweden	4,430
,, Switzerland	4,086
Insulated wire and flex	101,120
	(68,167)
To Sweden	12,379
,, Belgium	5,285
,, Holland	8,900
,, Colombia	4,134
,, Venezuela	4,550
,, India	5,100
,, Indonesia	2,916
Cables	180,400
	(130,028)
To Holland	35,007
,, Sweden	15,849
,, United States...	8,225
,, Argentina	13,388
,, Israel	6,731
Insulators	11,089
	(8,118)
To Austria	1,058
,, Switzerland	1,012
,, Israel	1,872
Filament lamps	18,217
	(17,887)
To Belgium	1,176
,, Holland	1,974
,, Norway	1,082
,, Sweden	2,653
,, Switzerland	1,024
Fluorescent lamps	1,913
	(1,812)
To Belgium	121
,, Holland	170
,, Austria	283
,, Sweden	270
Other lamps and parts	13,045
	(9,990)
To Italy	1,131
,, Holland	1,204
,, Sweden	2,138
Electronic tubes, cathode ray tubes and parts	32,280
	(30,629)
To United Kingdom	4,747
,, Belgium	1,635
,, Denmark	1,807
,, France	1,259
,, Italy	5,821
,, Holland	4,457
,, United States...	2,767
Parts of electrical machinery and apparatus n.e.s.	7,631
	(5,146)
To Holland	1,631
,, Sweden	1,171
,, Switzerland	930
Cable and power line accessories	8,010
	(7,874)
To Holland	917
,, Austria	870
,, Turkey	335
,, Israel	359
Complete power stations	33,743
	(79,652)
To Yugoslavia	5,706
,, Spain	8,167
,, Turkey	1,195
,, Egypt	5,821
,, Argentina	3,547
,, Brazil	1,344
,, Colombia	1,360
,, Iraq	1,621
,, Iran	1,810
,, Pakistan	1,342
Steam engines and turbines without boilers	17,480
	(19,128)
To United Kingdom	1,048
,, Belgium	2,629
,, Holland	2,735
,, Poland...	1,216
,, India	1,370
Water wheels and turbines	21,012
	(35,297)
To Finland	1,059
,, Norway	2,051
,, Austria	3,691
,, Switzerland	2,905
Air conditioning equipment	10,662
	(5,713)
To Holland	1,261
,, Egypt	832
,, Afghanistan	1,805
,, Italy	534
Industrial and household freezers and refrigerators	88,694
	(72,636)
To Belgium	10,809
,, Italy	12,914
,, Austria	12,673
,, Sweden	10,119
,, Switzerland	7,017
,, Egypt	1,601

Table 3.—Western Germany's Electrical Imports, 1955-56 (Main Supplying Countries) (Thousand DM)

Supplying Country	1956	1955
United Kingdom	26,362	25,226
Saar	7,709	8,208
Belgium/Luxembourg ...	7,343	6,448
Denmark	9,684	11,050
France...	7,630	6,484
Italy	4,361	2,885
Holland	56,418	53,804
Austria	10,240	7,048
Sweden	6,510	6,692
Switzerland	40,584	36,524
United States...	40,384	34,275

Table 4.—Production of Western German Electrical Industry in 1956

Class	Weight (hundred kg)	Value (thous. DM)
Motors and generators (excl. welding generators) ...	150,157	862,668
Transformers...	85,979	407,604
Rectifiers	6,070	72,964
Accumulators and batteries	55,804	164,448
Condensers and capacitors ...	2,024	33,876
H.v. switchgear and switchboards	22,794	178,088
L.v. switchgear and switchboards	51,675	505,136
Installation material, up to 750 V	37,806	300,892
Insulated wire and flex ...	115,713	574,884
Cables...	161,870	568,140
Power tools, up to 2 kW ...	4,362	83,736
Welding equipment... ...	9,496	73,124
Industrial furnaces	13,112	81,684
Heating appliances	73,020	428,580
Refrigerators, up to 250 litres	51,524	331,188
Wire communication equipment	11,847	437,028
Radio communication equipment	904	61,280
Signal and safety appliances...	5,156	73,072
Radio and TV equipment ...	73,412	1,054,196
Electrical acoustical apparatus	10,308	198,044
Measuring instruments ...	3,624	208,840
Household meters	3,095	81,120
Control and regulating equipment	3,715	120,848
Electro-medical apparatus ...	3,576	139,416
Industrial traction equipment	1,424	14,068
Electrical equipment (tractors and cars)	64,384	472,440

a large extent consisted of electronic equipment and domestic appliances. No doubt, with the continuation of a high standard of living in Western Germany, the demand for these goods will persist.

Though the increase in production of Western Germany's electrical industry was smaller than in previous years (16 per cent against 23 per cent), the upward trend continued (Table 4). In spite of heavy commitments in the home market, new export territories were opened up. Further automation and rationalisation increased the industry's competitive power in the face of rising wages and higher prices for raw materials. The proportion of the production exported rose from 20·8 per cent in 1955 to 21·8 per cent last year.

In 1956 the total number of employees in the industry was 546,577 of whom 415,691 were wage earners. Wages totalled 1,678 million DM and salaries 912 million DM. The turnover was valued at 11,744 million DM. An electricity consumption of 1,212 million kWh was recorded.

Future expansion of Western Germany's trade and industry will to a considerable extent depend on sufficient power supplies. Although she is utilising all her own resources and importing power from neighbouring countries, Western Germany is faced with a serious power shortage in the immediate future. She will therefore become the most important European market for nuclear plant and ancillary equipment. According to present plans, she should, by 1965, have an installed nuclear capacity of 1,500 MW. Possibilities exist for the supply of atomic power plant and technical information until Western Germany can manufacture reactors and fuels herself. The export outlook for the United Kingdom manufacturer is better than ever before by reason of the establishment of a common market and the possibility of selling nuclear power plant.

NEW BOOKS

Power System Communications. Edited by E. Openshaw Taylor, B.Sc., A.C.G.I., D.I.C., M.I.E.E. Pp. 304; figs. George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Price 35s.

The book fills an important gap in the bookshelf of the power engineer by giving him a sound engineering acquaintance with his most important service, communications. To cover such a broad subject in one volume necessitates brevity. This is achieved without loss of clarity and although formulæ are quoted without derivations, the bibliographies offer compensation for the meticulous.

In view of this compression and despite the complete omission of the Carpenter relays, it is a pity that so much space is devoted in the apparatus chapter to electromechanical components and their construction, whereas the transistor is awarded one sentence only in the previous chapter on communications circuits.

This unbalanced emphasis on what the power engineer should know occurs again in the section on telemetering. There, much more attention is given to the obsolescent methods than to the time-division multiplex system now being installed as standard equipment by the C.E.A. As a result, the overcoming of the channel limitations that can be caused by the need to transmit sign or direction is ignored.

The sections dealing with Post Office plant and carrier current equipment are excellent although the limitations on the use of power-line carrier in Britain with its continuously developing grid system, often involving the splitting of feeders into new points of supply, are not brought out.

The chapters on radio and television equipment, supervisory control and intertripping are outstanding in a lucid book made more than ordinarily readable by the excellent printing and circuit reproductions. There is a need, though, for a forward-looking chapter indicating the trends in communications apparatus design with silicon and germanium devices, in order to keep the book up to date for the next few years.—L.J.C.

The Cathode-Ray Oscilloscope. By J. Czech. Pp. 340; figs. Philips' Technical Library book distributed by Cleaver-Hume Press, Ltd., 31, Wright's Lane, Kensington, London, W.8. Price 57s 6d.

This book is the latest addition to the Philips' Technical Library and the author is a member of the staff of the German branch of the Philips Company. In view of the sub-title, "Circuitry and Practical Applications," the reader will not be surprised to find that the construction and behaviour of the tube itself are summarily dismissed. Power supplies, time bases and X and Y deflection amplifiers are discussed in more detail. Next, the author describes general measuring techniques, starting with the setting up of the instrument. In this part, sections are devoted to amplitude measurement, the instrument as bridge null indicator, the display of hysteresis loops and intensity modulation and it concludes with phase and frequency measurements.

Part III deals with examples, covering the recording of waveforms of luminous flux, etc., measurements on TV receivers, camera shutters, flash bulb synchronisers and the like, and delay measurements on lines and networks. The last part describes in considerable detail the design of a small oscilloscope, a special oscilloscope with less restricted uses and a time base expansion unit for examining TV line and frame scans. A lengthy bibliography is included.

The book is accurate and carefully written. It is beautifully illustrated with very many photographic reproductions of oscillograph traces. In spite of this it fails to become a major addition to the literature on the subject, for it does not deal with many important modern advances. Among the major omissions are the use of oscillographs at very high frequencies, including, e.g., delay line deflection systems, and very high-speed time bases, the use of r.f. e.h.t. generators and fly-back e.h.t. generators. Even points of technique such as the use of built-in voltmeters for d.c. voltage measurement are not mentioned. This reduces the work to the status of one for beginners only.—A.H.W.B.

BOOKS RECEIVED

Atmospheric Electricity. By J. Alan Chalmers, M.A., Ph.D., F.Inst.P. Pp. 327; figs. Pergamon Press, Ltd., 4 & 5, Fitzroy Square, London, W.1. Price 63s.

Radiation Shielding. Vol. 2. By B. T. Price, M.A., C. C. Horton, B.Sc., and K. T. Spinney, B.Sc. Pp. 350; figs. Pergamon Press, Ltd. Price 60s.

Internal Audit in the Public Boards. By W. L. Abernethy, A.S.A.A., F.I.M.T.A. Pp. 189; tables. Shaw & Sons, 7-9, Fetter Lane, London, E.C.4. Price 27s 6d.

Man and Automation. By L. Landon Goodman. Pp. 286; figs. Penguin Books, Ltd., Harmondsworth, Middlesex. Price 3s 6d.

GENERATION AND DEVELOPMENT

C.E.A. Contracts

Contracts have been placed by the Central Electricity Authority during the past month for power stations, transforming stations and transmission lines, amounting in the aggregate to £7,144,560. The principal contracts include:—

Northfleet station: One 120 MW reheat turbo-generator, condensing and feed heating plant.—General Electric Co. 6·6 kV/415 V auxiliary transformers.—Bryce Electric Construction Co.

Drakelow "B" station, Burton-on-Trent: Coal handling plant.—International Combustion Products.

Uskmouth "B" station, Newport: Structural steelwork.—Braithwaite & Co. Structural.

Padiham "B" station, near Burnley: Two 120 MW turbo-generators.—British Thomson-Houston Co., Ltd. Condensing and feed water heating plants.—Vickers-Armstrongs (Engineers).

Blyth station: 66 kV switchgear.—A. Reyrolle & Co.

Bradwell substation: 132 kV switchgear.—A. Reyrolle & Co.

Stockport: 25 kV and trunk multicore cables.—W. T. Henley's Telegraph Works Co.

Rochdale substation: 132 kV switchgear.—English Electric Co.

Bromborough, Chester and Knutsford substations: 132 kV switchgear.—Ferguson Pailin.

Penn substation: Site and foundation works.—Wilson Lovatt & Sons.

Christchurch-Nursling/Bournemouth: 132 kV overhead line.—Riley & Neate.

Spondon-Annerley-Chesterfield: 132 kV overhead line.—W. T. Henley's Telegraph Works Co.

Southern Electricity Board Tariffs

The Southern Electricity Board has reviewed its financial position in the light of the substantial increases in costs which have occurred since the last general increase of tariffs was made nearly two years ago. Increases of costs in the period due in the main to rises in wages, salaries and the cost of bulk supplies of electricity now represent £3 million per annum, and the latest estimates show that unless steps are taken to increase tariffs the Board will incur a substantial deficit in the current year, and a deficit of nearly £1 million in 1958-59. In order therefore to restore its financial position, to provide revenue towards greater provision of the capital necessary to reinforce and extend the system, and to secure a reasonable period of stabilisation of tariffs, the Board has decided to increase the general level of tariffs so as to yield in a full year additional revenue of £3,100,000.

The principal tariff changes which will take effect for electricity consumed on and after the date of the first normal meter reading following 30th September next are as follows:—The primary rate and the secondary rate of the standard domestic, commercial and farming block tariffs will be increased by ½d per kWh and ¼d per kWh respectively. The monthly and annual maximum demand tariffs available to industrial consumers will be increased by 1s 6d per kVA per month, and 15s per kVA per annum respectively, and the "unit" rate will be increased by 0·025d.

South Western Off-Peak Tariffs

The South Western Electricity Board has decided to revise its off-peak tariffs. The broad effect of the changes is that all consumers who take supplies during off-peak hours will have the use of the supply for longer periods at cheap rates. For example, consumers taking low voltage supplies of 20 kW or more will pay only about 0·9d/kWh; the price will vary according to the hours of use selected by the consumer. Apart from the reductions in price, supply may be used up to 7.30 a.m., instead of 7 a.m., and in the evenings from 6 p.m., instead of 7 p.m.; the supply may be used all day on Sundays, except between noon and 1 p.m.; where required, the supply can be made available between 1 p.m. and 4 p.m. on weekdays on payment of 12s 6d/kW per annum.

Electric Bath-Heating Proposal

The West Bromwich Baths and Estates Committee has recommended that electric heating plant shall be installed at the public baths at a cost of £13,000. It estimates that the annual running cost will be between £5,000 and £5,500. According to the *Birmingham Post,* "this follows an assurance by the Midlands Electricity Board that with the continued development of nuclear power consumer costs for electricity should be reduced and that the benefits of this development could be expected in five to ten years."

Irish Peat Station

Production of electricity at the second section of the Ferbane power station has begun, and production by the third and final portion will commence about September. The station will ultimately have a capacity of 60 MW.

Floor Warming at Lambeth

Lambeth Borough Council's new 16-storey block of flats to be built in Canterbury Crescent, Brixton, will have electrically-heated floors. A display showing the design of these flats is now in progress at the Astoria Cinema, Stockwell Road, S.W. Included in the display are photographs of the first 3,000 houses and flats built by Lambeth since the war; a model of the Canterbury Crescent "warm floors" estate; and drawings, perspectives and full-scale sections of heated flooring.

Overhead Line Consent Refused

As a sequel to an inquiry held at Dorchester last December, the Minister of Power has refused to sanction the construction by the Central Electricity Authority of an overhead line between Corfe Mullen and Yeovil. His decision in connection with the remainder of the line, between Corfe Mullen and Poole, has been deferred.

Cookers in New Houses

The Durham Rural District Council has instructed the housing architect to install electric cookers in new houses at present under construction where it is practicable to do so. This will involve the cancellation of orders for solid fuel ranges.

Street Lighting

The chairman of Exmouth Urban Council (Mr. A. E. Humphries) recently officially switched on a new £12,000 street lighting scheme through **Exmouth.** He said it would improve the town's status as a leading holiday resort.

Chester City Council has approved a scheme for relighting Sealand Road from Bumpers Lane to the city boundary with sodium lamps at a cost of £3,000.

Blaydon (Co. Durham) U.D.C. is to spend £2,950 on an electric street lighting scheme.

Sheffield Transport in 1956-57

During the year ended 31st March last the Sheffield Transport Department earned a total revenue of £3,939,938, as compared with £3,838,779 in the preceding year; the net balance was £19,992 (against £24,149). There was an adverse balance of £3,677 on the working of the tramways (against a surplus of £176,232 in 1955-56) but the surplus on the motor buses rose from £420,331 to £437,898. During the year the number of trams in service was reduced from 338 to 265 while the number of buses rose from 666 to 710. The manager of the Department is Mr. R. C. Moore, M.Inst.T.

Wolverhampton Transport

The accounts of the Wolverhampton Transport Department for the year ended 31st March last record a gross profit on the operation of the trolleybuses of £145,890 (against £96,847 in 1955-56) while a deficit of £17,508 (against £35,974) was incurred by the

motor buses. After meeting loan charges, etc., there was a net surplus of £3,717, against a net deficit of £67,352 for 1955-56.

Mr. R. H. Addlesee, M.Inst.T., the general manager, mentions the difficulties occasioned by the Suez affair and notes an extension of the Amos Lane trolley-vehicle route during the year. At 31st March the Corporation was running 153 trolley-buses and 134 motor buses, the respective total vehicle mileages being 5,726,472 and 4,793,786. A total of 15·6 million kWh was used by the trolley-buses. The percentage of total expenses to total revenue was:—Trolley-buses 91·09; motor buses 112·23.

OVERSEAS

Power for Aluminium

The Aluminum Company of Canada, Ltd. (Alcan), reports that steady progress is being made on its new hydro-electric project at Chute-des-Passes on the Upper Peribonka River in Quebec. The scheme involves blasting a six-mile tunnel to connect the reservoir with an underground power house now being excavated. The power house cavern will house five 200,000 h.p. turbo-generators utilising a gross head of 635ft when the reservoir is full. At the power house end, the 35ft diameter tunnel will divide into five penstocks. The waters are discharged through a second 1¼ mile long tunnel into the Peribonka River, flowing south for use again in the Saguenay area power stations.

The project will cost about $150 million. Generation should start by the summer of 1959 and the whole scheme is scheduled for completion by mid-1960. A new transmission line will be built to carry the power 100 miles south to Isle Maligne, where it will be distributed to Alcan's smelters in the area.

The Chute-des-Passes development is part of an expansion programme which includes the construction of facilities to produce an extra 120,000 tons of aluminium a year in the Saguenay area.

Power Supplies in East Africa

Recently Mr. Michael Blundell, the Minister of Agriculture in Kenya, was reported in the *Uganda Argus* to have said that the Seven Forks hydro-electric project in Kenya would reduce the cost of power to a quarter of that produced by thermal generation at present and half the cost of power transmitted from Jinja, in Uganda. Doubling of the transmission line from Jinja, it was stated, would cost £11 million, or £1 million less than the Seven Forks scheme.

Commenting on this in a letter to the *Argus*, Mr. E. H. Wilson, secretary of the Uganda Electricity Board, said it had appeared to the Board for some time that substantial savings in capital could be made by co-operation between the Board and the electricity supply company in Kenya regarding future supplies of electricity in the two territories. Following preliminary discussions in Nairobi last September, a memorandum prepared by the Board's consulting engineers was sent to the company by the Board. This pointed out that by 1970 an approximate saving of £10 million in capital would be achieved if, instead of proceeding with the Seven Forks scheme meanwhile, further dams on the Nile were constructed and a 275 kV transmission line erected between Jinja and Nairobi. This allowed for the cost of a £12·8 million transmission line between Jinja and Nairobi which would take more than twice the effective output of the Seven Forks station. Any saving in capital cost would, of course, benefit Uganda and Kenya and would affect the price of electricity to consumers in these two territories. No comments of any kind on this memorandum had yet been received by the Board.

At the request of the power company, a possible tariff was given for additional bulk supplies by the Board, but it was pointed out that no information had been received from the company regarding the characteristics of the Kenya load. In the very tentative tariff given there was nothing to suggest that the price would be twice the cost of power from Seven Forks.

On 31st March last, at a meeting in Kampala between the chairman of the Board and the chairman of the company, the Board suggested that discussions should take place between the consulting engineers of the Board and the company to make sure that the capital costs of the various schemes were on the same basis. This offer was accepted by the company, who also promised to let the Board have comments on the consulting engineers' memorandum.

Mr. Wilson added that the next dam on the Nile was likely to be some miles below Owen Falls. Borings had already been made. With the largest reservoir in the world behind them, and nearly 60 years of reliable hydrological data, all Nile stations could provide power all the year round without requiring any standby thermal plant using imported oil.

Second Generator at Eildon

A second 60 MW generator has now been commissioned at the State Electricity Commission's new Eildon power station in Victoria. The station will have an average annual production of 227 million kWh. Both the 60 MW generators, the largest so far installed in the State, were manufactured by the British Thomson-Houston Co., Ltd., and the turbines by Boving & Co., Ltd.

The station utilises the waters released from the Eildon irrigation reservoir which has been enlarged to 750,000 gal capacity, almost nine times its original size, to provide additional irrigation water for the Goulburn Valley.

Progress of Kariba Scheme

The Italian firm of contractors engaged in the construction of the Kariba hydro-electric scheme on the Zambesi River are reported to have caught up with their schedule after six weeks' delay caused by floods in March; the work was then a month ahead of the programme. The first section of the dam has now been completed and the river will flow through a diversion channel on the north bank while work proceeds on the next section.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

Monday, 15th July

LONDON. — Woolwich Polytechnic Hall, Calderwood Street, Woolwich, S.E.18, 7 p.m. Predetermined Motion Times Lecture.

Monday, 15th July, to Saturday, 20th July

MANCHESTER. — Heaton Park. Building Plant Exhibition.

Friday, 19th July

LONDON. — Olympia. Plastics Institute, 12 noon. Annual general meeting, followed by annual luncheon.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to the dates mentioned:—

19th July

VERTISPEED. No. 763,629. Class 9. Electric arc welding electrodes.—Quasi-Arc, Ltd., Bridgewater House, Cleveland Row, St. James's, London, S.W.1.

26th July

SPEEDOMAX. No. 756,173. Class 9. Electrical measuring apparatus and instruments; electrical apparatus and instruments for recording and indicating temperature, physical forces, speed and electric current; and electrical apparatus for use in automatically controlling the action of machinery or industrial plant.—Leeds & Northrup Co., Philadelphia, Penn., U.S.A. Address for service, c/o Mewburn Ellis & Co., 70-72, Chancery Lane, London, W.C.2.

No. 759,926 (design). Class 9. Electric coils, transformers, electric chokes, transductors, solenoids and electronic amplifiers.—Westool, Ltd., St. Helens, Auckland, Co. Durham.

HANOVIA (design). No. 761,227. Class 9. Photographic, printing apparatus and parts; electronic apparatus for automatically controlling the operation of valves in fluid pipe line systems; and electrically operated valves for automatically controlling the flow of fluids in pipe line systems. HANOVIA (design). No. 761,228. Class 10. Electric infra-red heating apparatus, electric ultra-violet apparatus and parts, all for surgical or curative purposes.—Engelhard Industries, Ltd., 52, High Holborn, London, W.C.1.

Babcock & Wilcox, Ltd., have applied for the registration of a number of trade marks covering containers for use in the storage and transport of radio-active material, steam-raising plant, machines for use in the mechanical handling of nuclear fuel and radio-active material, etc. Full particulars are given in the *Trade Marks Journal* for 26th June.

REPORTS and DIVIDENDS

Ferranti, Ltd.—The main figures in the accounts for the year ended 31st March were given in our issue of 21st June. In his statement which accompanies the report and accounts, Sir Vincent de Ferranti (chairman) says that during the year under review the figure for unexecuted orders reached an all-time record of £21 million. Last year stress was laid on the vital importance of an extensive programme of research and development. They have built up a team of over 200 engineers and mathematicians for the development and exploitation of electronic digital computers. Six "Pegasus" models have been delivered, and this type of machine is coming off the production line at the rate of one per month. The machines already delivered, together with orders in hand, covered many interesting applications in aircraft and other industries. The first "Mercury" high-speed computers will be delivered shortly, and orders are in hand for these for the Norwegian Defence Research Establishment, the United Kingdom Atomic Energy Authority, the Council for European Nuclear Research, the French Commissariat a l'Energie Atomique, the Air Force Meteorological Office and for London and Manchester Universities. Sir Vincent refers to the development of radar and electronic circuits, servo-mechanisms, gyroscopes, and other equipment for guided weapons, radar equipment for aircraft and work on Naval anti-aircraft gunnery control systems. In the field of electronic devices, production of silicon diodes has been stepped up during the year to meet a steadily increasing flow of orders.

Turning to power transformers, Sir Vincent says that input has once again reached a record figure, and this includes the largest transformer contract yet placed in this country by an overseas buyer, comprising two 120 MVA and ten 60 MVA 330 kV three-phase units for the Kariba scheme of the Federal Power Board of Rhodesia and Nyasaland. Orders received for the home market include a number of 275 kV class transformers of ratings up to 225 MVA. Output shows a slight increase on the figure for last year, and includes the delivery of upwards of 1,400 MVA of large transformers in the 132 and 275 kV class to the C.E.A., and 600 MVA of large units for voltages up to 300 kV overseas. During the year the input of orders for high-voltage testing equipment has also been a record, and deliveries included a one million-volt outdoor testing transformer for the National Physical Laboratory, Teddington. The input of orders for electricity meters both from home and overseas customers has remained steady.

In the domestic field, the sales of electric fires and "Fridge-Heaters"

Our Stock Exchange Contributor is on holiday. His weekly notes will be resumed in our 19th July issue.

Price Changes in

Company or Board	Nom. Value	Middle price 8th July	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1957 Highest	1957 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	72½	−1	3	3	4 2 9	80	72½
Brit. Elec. 1974/77	100	70½	−1	3	3	4 5 0	78½	70½
Brit. Elec. 1976/79	100	73½	−1	3½	3½	4 15 3	81½	73½
Brit. Elec. 1974/79	100	84½	−1	4¼	4¼	5 0 6	92½	84½
Overseas Electric Supply								
Calcutta Elec.	£1	16/-		6†	6†	7 10 0†	19/-	16/-
East African Power	£1	19/-		7	7	7 7 3	21/-	19/-
Nigerian Elec.	£1	17/6		10	10*	11 8 6	18/6	17/3
Perak Hydro-Elec.	£1	17/6	−6d	10	10*	11 8 6	18/-	13/3
Electrical Shares								
Aberdare Cables	5/-	12/6		17½	17½	7 0 0	12/6	9/9
Aerialite	1/-	5/9		45	48	8 6 9	6/-	4/9
Allen, W. H.	£1	46/10½		10	10	4 5 6	47/3	33/6
Anglo-Portuguese Tel.	£1	24/3		8	8	6 12 0	27/6	20/6
Aron Elec. Ord.	£1	58/9		15	15	5 2 3	60/-	53/6
Assd. Automation	10/-	24/3		5	7½	3 1 3	24/9	17/9
Assoc. Elec. Ord.	£1	62/6	−1/3	15	15	4 16 0	73/-	62/6
Automatic Tel. & El.	£1	75/-		15	17	4 10 9	75/-	54/6
Babcock & Wilcox	£1	70/-	−7½d	15	15	4 5 9	82/6	70/-
Bakelite	10/-	24/4½		16	15	6 3 3	24/6	20/9
Baldwin, H. J.	2/-	3/10½		20	20	10 6 0	5/-	3/10½
Berry's Electric	5/-	6/-		—	10	8 6 9	6/3	5/6
British Aluminium	£1	67/6		12	12	3 11 0	71/3	63/9
Brit. Elec. Traction: Def. Ord. "A"	5/-	23/6xd	−3d	22½	25	5 6 6	24/6	17/-
B.I. Callender's	£1	51/-	−2/3	12½	12½	4 18 0	55/-	48/3
B.I. Callender's 6% Pref.	£1	19/6		6	6	6 3 0	21/9	19/6
British Tabulating	£1	55/-		9	9	3 5 6	56/3	42/-
British Thermostat	5/-	25/-		25	25	5 0 0	27/6	25/-
British Vac. Cleaner	5/-	6/6		15	10	7 13 9	8/-	6/6
Brook Motors	10/-	37/6	+1/3	25	15	4 0 0	37/6	30/-
Brush Group	5/-	7/9		10	Nil	—	8/-	4/6
Bulgin, A. F.	1/-	4/9		50	40*	8 8 6	5/6	4/6
Burco Dean	5/-	13/6		22½	20	7 8 3	13/6	8/9
Cable & Wireless: Ord.	5/-	12/-		10	10	4 3 3	12/-	9/6
4% Loan	100	90½		4	4	4 8 6	92½	89
Chloride El. Storage "A"	£1	66/10½	−7½d	17½	17½	5 4 9	68/9	58/-
Clarke Chapman	£1	180/-	+5/-	22½	27½	3 1 0	9	6½
Cole, E. K.	5/-	21/-	−3d	17½	17½	4 3 3	23/6	16/6
Cossor, A. C.	5/-	5/9		15	Nil	Nil	7/3	5/9
Crabtree	10/-	25/6	−6d	20	20	7 17 0	26/-	23/3
Crompton Parkinson Ord.	5/-	16/9		16	16	4 15 6	17/9	14/6
De La Rue	5/-	24/6xd	+2/6	30	35	7 3 0	24/6	16/3
Decca "A"	4/-	28/1½	+1/3	43¾	43¾	6 4 6	32/3	26/10½
Desoutter	5/-	33/9	+3d	30	32½	4 16 6	33/9	27/6
Dewhurst	2/-	7/6		30	16½*	4 6 9	7/6	5/9
Dictograph Tel.	2/-	5/9		20	20	—	6/3	5/9
Dubilier Condenser	1/-	7/3		25	30	4 2 9	7/3	5/6
Duport	5/-	19/-		23	25	6 11 6	19/6	17/6
E.M.I.	10/-	34/9	+1/6	15	15	4 6 3	34/9	23/9
Electrical Components	5/-	7/6		25	25	8 6 9*	7/6	6/6
Elec. Construction	£1	26/3	−1/3	8½	8½	6 9 6	27/6	21/9
Elliott Bros.	5/-	32/2½		17½	20	3 2 3	33/6	26/3
Enfield Cable Ord.	£1	14/6		Nil	Nil	Nil	21/6	13/-
English Electric	£1	61/3	+1/3	12½	14	4 11 6	61/3	47/6
English Electric 3¾% Pref.	£1	12/-	−6d	3¾	3¾	6 5 0	14/3	13/-
Ericsson Tel.	5/-	49/-		20†	22†	2 4 9†	49/-	33/3
Ever Ready	5/-	39/3	−1/-	35	37½	4 15 9	40/3	30/-
Falk Stadelmann	£1	39/8½		17½	17½	8 16 6	40/6	35/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

have increased but the high level of purchase tax hinders attempts to expand in this field.

Ultra Electric (Holdings), Ltd.—The accounts for the year to 31st March, now issued, confirm the figures given in our issue of 5th July.

In his review of the year Mr. E. E. Rosen (chairman) says that an accumulation of radio and television stocks and work in progress had to be realised under conditions of extreme competition because other manufacturers found themselves in a like situation and some losses were inevitable. Whilst realisation was taking place, production of radio and television at the Western Avenue factory was discontinued. Although the new factory at Gosport was occupied in July last year, its production was confined in the early months to the completion of work already in progress. In the special products branch, although they had substantial contracts in hand, output was limited by technical difficulties which were not entirely within their control. With regard to the current year, sales since 1st April exceed those in the corresponding period of any previous year and the directors are satisfied with the trading results.

Electrical Investments

Company or Board	Nom. Value	Middle price 8th July	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1957 Highest	1957 Lowest
Electrical Shares—continued						£ s d		
G.E.C. Ord.	£1	55/-	−1/3	12½	14	5 2 0	58/9	48/9
G.E.C. 6½ Pref.	£1	20/6	−6d	6½	6½	6 7 0	23/6	20/6
General Cables	5/-	13/9		30	30	10 18 3	13/9	11/6
Greenwood & Batley	£1	47/6		17½	17½	7 7 3	47/6	45/3
Hackbridge Holdings	5/-	18/9	−1/-	25	30	8 0 0	21/9	18/9
Hackbridge & Hewittic	5/-	15/-		23	20	6 13 6	16/-	13/6
Head Wrightson	£1	143/9		20	22½	3 2 6	146/3	112/6
Heatrae	2/-	4/6xd		15	15	6 13 3	4/6	4/-
Henley's	10/-	15/-	−9d	11½	11½	7 13 6	17/-	15/-
Holophane	5/-	25/-	−1/3	30	30	6 0 0	26/3	17/-
Hoover	5/-	42/6	−6d	50	50	5 17 6	44/-	24/9
I.C.I.	£1	45/3	+9d	10	10	4 8 6	46/6	37/9
Intl. Combustion	5/-	26/6		20	22½	4 5 0	30/-	20/-
Johnson & Phillips	£1	28/1½	−7½d	15	10	7 1 6	34/6	28/-
Lancashire Dynamo	£1	43/9	−1/3	11	11	5 0 6	45/-	36/9
Laurence, Scott	5/-	17/9	+6d	15	15	4 4 6	19/9	13/9
Lister, R.A.	£1	32/6		10	10	6 3 0	33/9	26/9
London Elec. Wire	£1	46/10½	−7½d	12½	12½	5 6 9	53/9	43/-
Lucas, J.	£1	35/6	+1/3	7½	7½	4 4 6	36/6	30/6
Marconi Marine	£1	35/-	+6d	10	10	5 14 3	35/-	31/-
Marryat & Scott	2/-	13/-		30	35	5 7 9	13/-	8/-
Mather & Platt	£1	61/3	−7½d	15	15	4 18 0	63/9	51/3
Metal Industries	£1	30/-	+3/-	Nil	9	—	30/-	20/3
Midland Elec. Mfg.	£1	48/9		12½	12½	5 2 6	48/9	45/-
Morphy-Richards	4/-	18/9	+3d	50	50	4 5 6	18/9	11/9
Murex	£1	79/4½		20	20	5 1 0	79/6	65/-
Newman Ind.	2/-	2/9		10	10	7 5 6	2/9	2/1
Oldham & Son	1/-	2/4½		20	17½*	7 7 6	2/6	2/3
Parnall (Yate)	5/-	7/3		12	12	8 5 6	8/9	5/9
Parsons, C. A.	£1	67/6	−1/3	10	8½*	—	71/3	50/6
Plessey	10/-	85/9	−3d	27½	30	3 10 0	86/3	61/-
Pye "A" Deferred	5/-	20/-	+7½d	12½	12½	3 2 6	20/-	15/9
Reyrolle	£1	100/-	−1/3	16½	17½	3 10 0	110/-	90/-
Rheostatic	4/-	9/-		18½	12½*	5 11 0	10/-	8/9
Richardsons Westgarth	5/-	18/9	−3d	16⅝	16⅝	4 9 0	20/-	17/-
Scottish Cables	4/-	17/3		27½	27½	6 7 6	19/3	15/-
Simon-Carves	5/-	35/-		28½	20*	2 17 3	35/-	26/-
Smith (England), S.	4/-	15/-		17½	17½	4 13 3	15/9	13/-
Southern Areas	£1	15/-	−2/6	7½	7½	10 0 0	20/-	13/9
Strand Elec.	5/-	7/3		15	15	10 6 9	8/-	7/3
Sturtevant	5/-	22/9	−3d	15†	15†	3 6 0†	27/-	22/9
Sun Elec.	£1	43/9		20	25	11 8 6	43/9	43/9
Switchgear & Cowans	5/-	13/9	−6d	25	25	9 2 0	15/6	13/6
Taylor Tunnicliff	5/-	12/9		15	15	5 17 9	13/9	11/9
T.C.C.	10/-	40/-		25	25	6 5 0	40/-	35/-
T.C. & M.	£1	25/-		8½	8½	6 16 0	31/-	24/6
Telephone Mfg.	5/-	6/-	+3d	10	10	8 6 6	8/-	5/9
Telephone Rentals	5/-	11/9		12½	12½	5 6 6	12/6	10/3
Thompson (John)	5/-	32/3		25	25	3 17 6	37/-	29/3
Thorn Elec.	5/-	25/7½	+7½d	15	15	2 18 6	26/3	16/3
Thornycroft	£1	28/9		15	12½	8 14 0	37/6	28/9
Tube Investments	£1	66/3		22½	15*‡	4 10 6	68/9	58/3
Vactric	5/-	20/-	−1/3	17½	25	6 5 0	23/9	12/9
Veritys	5/-	9/-		12½	12½	6 19 0	9/3	8/3
Walsall Conduits	4/-	14/4½	−7½d	20	20	5 11 3	15/-	11/-
Ward & Goldstone	5/-	53/9	+7½d	30	35	3 5 0	56/3	36/9
Watford	2/-	6/6		25	25	7 13 9	6/9	6/3
Westinghouse	£1	38/9	−1/3	18	9‡	4 13 0	41/3	36/-
West, Allen	5/-	17/3	−3d	15	15	4 7 0	17/9	12/3
Wolf Electric	5/-	11/6		20	20	4 7 0*	13/6	8/9

The Electric Construction Co., Ltd. The accounts for the year to 31st March last were abstracted in our issue of 21st June.

In his review of the year, Mr. C. Reid (chairman) says that the new factory for the production of automatic control gear is now in production. The company has contracts for automation equipment for many industries; this plant embraces all the company's major products—motors, transformers, rectifiers, automatic control gear, and industrial equipment. Referring to the subsidiary companies, Tyseley Foundry, Ltd., has had another successful year although the profits are somewhat lower than last year. While the South African subsidiary has not made a profit, the results show a considerable improvement over last year. With regard to future prospects the order book continues at a high level.

The Telephone Manufacturing Co., Ltd.—The annual meeting was held on Monday last, Mr. F. T. Jackson (chairman and managing director) presiding. In his circulated statement the chairman said that in spite of the shortage of labour the company had a successful year. Turnover increased by 14 per cent, and of the total output 19 per cent went to overseas customers. Orders in hand on behalf of the British Post Office were substantial. The activities of the Post Office had been affected by the restrictions on credit and also by the increases in its tariffs. As a result the waiting list for telephone service was now being overtaken much more rapidly and it seemed certain that the value of contracts to be placed in the current year would be on a lower level than in the past few years.

Telephone Rentals, Ltd.—In the course of his review of the past year, presented at the annual meeting held on 1st July, Mr. F. T. Jackson (chairman and joint managing director) said that they set themselves a target of business to be obtained at the beginning of each year, and this target

was exceeded by more than 10 per cent for the year under review. Up to the end of the first four months of the current year the revised target had again been exceeded.

Overseas, they were still limiting their activities in Canada to Toronto, and were gradually building up a successful business around that city. Their companies in South Africa were on a profit-earning basis. The company in Australia, which at the present time was not wholly owned by them, had a satisfactory year and now had a substantial rental income. The Paris and Brussels companies had both operated at a small profit.

Vent-Axia, Ltd.—The report and accounts for the year to 31st March last, now issued, confirm the figures given in our issue of 14th June. The company proposes to make a two-for-one scrip issue, capitalising £131,200 of reserves, and is arranging to raise £200,000 by a private issue of 6¼ per cent medium-term secured loan stock.

In his statement Mr. J. C. Akester (chairman) says that although total sales for the past year were higher than those of the previous year the increase was not quite sufficient to offset higher costs. The further increase in sales during the first quarter of the current financial year has been encouraging and selling prices have not been altered, but whether it will be possible to maintain this policy of holding prices if costs rise still further remains to be seen. Development of the export side continues and progress has been made in several countries which has more than compensated for reduced sales in one or two others where further import restrictions have been imposed. The export business now amounts to nearly one-third of the company's home turnover.

Metal Industries, Ltd.—The group trading profit for the year ended 31st March last is £1,551,506, as compared with a loss of £544,923 for the preceding year, to which is added exceptional profits of £75,853, arising from a change in the basis of valuation of stocks. Taxation absorbs £827,262, and the net balance is £800,097 (against a loss of £420,256). It is proposed to pay a final dividend of 6 per cent, making 9 per cent for the year, and in view of the recovery and the fact that no payment was made on the ordinary capital for 1955-56, a special bonus of 5 per cent is also recommended. The balance carried forward is £425,391.

Berry's Electric Magicoal, Ltd., reports a group profit for the year to 31st March last of £138,229, as compared with £144,628 for 1955-56. Taxation requires £70,372 and £17,280 is retained by the subsidiary, leaving available £50,577 (£69,004). Preference redemption reserve receives £5,528 and £17,467 is written off preliminary expenses. It is proposed to pay a final dividend of 6 per cent, making 10 per cent for the year. The balance carried forward is £8,996.

James Scott & Co. (Electrical Engineers), Ltd., reports that after allowing £104,290 for taxation, the net profit for the year to 31st January last is £94,401, as compared with £90,009 for the previous year. It is proposed to pay a final ordinary dividend of 15 per cent (against 13 per cent), making 20 per cent (18 per cent) for the year.

Hick, Hargreaves & Co., Ltd.—After providing £322,985 for taxation and crediting £56,000 unrequired provisions, the net profit for the year to 31st March last is £330,519, as compared with £294,829 for the preceding year. It is proposed to pay a final dividend of 10 per cent and a bonus of 3½ per cent, making 18½ per cent for the year. A similar distribution was made for 1955-56, but the interim dividend in that year was paid on smaller capital.

The Electric & General Investment Co., Ltd., is offering ordinary stockholders 50,000 £1 ordinary shares at par in the proportion of one share for each £8 ordinary stock held. The new shares will not participate in any dividend paid for the year ended 31st May last.

Marryat & Scott Holdings, Ltd., report that, after providing £90,852 for taxation, the net profit for the year to 31st March last was £81,364, as compared with £69,396 for 1955-56. The dividend for the year is 35 per cent (against 30 per cent).

Increases of Capital

Electric Construction Co., Ltd.—Capital increased by £300,000, in £1 ordinary shares, beyond the registered capital of £1,300,000.

Venner Accumulators, Ltd.—Increased by £249,000, in £1 ordinary shares, beyond the registered capital of £1,000.

Fulham Electrical Components, Ltd.—Increased by £9,000, in £1 ordinary shares, beyond the registered capital of £1,000.

London Electrical Manufacturing Co., Ltd.—Increased by £99,400, in £1 ordinary shares, beyond the registered capital of £600.

New Companies

A. F. Glaze, Ltd.—Registered 20th May. Capital £25,000. To acquire the business of an electrical engineer now carried on by A. F. Glaze at 2, Dudley Road, Wolverhampton, as "A. F. Glaze," etc. Directors: A. F. Glaze, F. B. Glaze and Florence V. V. Glaze. Regd. office: 2, Dudley Road, Wolverhampton.

Nuclear Power Exhibition, Ltd.—Registered 5th June. Capital £20,000. To carry on the business of proprietors, promoters and managers of an International Nuclear Power Exhibition, etc. Solicitors: Sanders & Co., 32, Savile Row, W.1.

Meech Electric Drives (London), Ltd.—Registered 22nd May. Capital £100. Directors: J. R. Radington-Meech and Una G. Meech-Hearne. Regd. office: 150, Clapham Manor Street, S.W.14.

Amphenol (Great Britain), Ltd.—Registered 24th May. Capital £100. To manufacture, construct, produce, assemble, sell or otherwise deal in connectors, plugs, sockets, relays, adaptors, elements, insulators, materials and components for electrical and electronic purposes generally, and in electrical equipment of all kinds, etc. Gas Purification & Chemical Co., Ltd., and Amphenol Electronics Corporation, so long as they each hold 50 per cent of the issued shares, have the right to appoint and remove three directors. Solicitors: Clifford-Turner & Co., 11, Old Jewry, E.C.2.

Johnson & Turner (1957), Ltd.—Registered 4th June. Capital £2,000. Electrical engineers and contractors, manufacturers, distributors and repairers of and dealers in electric motors, etc. Directors: T. Warrington and E. Cauldwell. Regd. office: Hewitt Street, Hyde, Ches.

William Robb, Ltd.—Registered 11th April. Capital £4,000. Electrical engineers, general electrical installation contractors, etc. Directors: W. E. Robb and Mrs. Ada E. Robb. Regd. office: 15, Worcester Street, Gloucester.

S.C.E.E., Ltd.—Registered 15th April. Capital £5,000. Electrical and electronic engineers, etc. Directors: A. D. Bayliss and A. R. Wilcox. Regd. office: Reddicap Trading Estate, Coleshill Road, Sutton Coldfield.

C. Sharp and Son, Ltd.—Registered 10th May. Capital £25,000. To acquire the business of C. Sharp & Son, carried on by C. Sharp and R. A. Sharp at Darlington; and to carry on the business of electrical engineers, general electrical and refrigeration installation contractors, manufacturers and repairers of and dealers in radio and television sets, etc. Solicitors: Latimer, Hinks, Marsham & Little, Darlington.

T. J. Butler (Electronics), Ltd.—Registered 26th June. Capital £15,000. Manufacturers, wholesalers and retailers of radio, television and electronic equipment of all kinds, etc. Directors: T. J. Butler and Mrs. Mary Butler. Regd. office: 59, Chester Road West, Shotton, Flints.

Eagle Electrical, Ltd.—Registered 14th May. Capital £500. Manufacturers and repairers of and dealers in all kinds of electrical machinery and electrical apparatus, radio, television, etc. Directors: J. E. Bush, J. F. Carter, F. C. Gale and C. T. Rogers. Regd. office: 746, High Road, Tottenham, London, N.17.

Bankruptcies

J. E. Stephens, lately carrying on business under the style of J. Edryd Stephens & Sons, at 10, Barn Road, Carmarthen, electrical engineer.—Public examination 23rd September at the Guildhall, Carmarthen.

G. Moore, lately carrying on business under the style of the Electric Meter Co., at 123, Hele Road, Torquay, and 2, Barnhill Road, Torquay, electrical engineer.—Trustee, Mr. J. E. Ellis, 50, The Terrace, Torquay, appointed 25th June.

W. V. Tupling, 27, Church Street, Warsop, Notts, electrician.—Last day for receiving proofs for dividend 19th July. Trustee, Mr. R. F. Bendall, 126, Colmore Row, Birmingham, 3.

J. Summerly, 93, Mowbray Road, South Shields, electrician.—First dividend of 2s 2½d in the £, payable at the office of the Official Receiver, Clarendon House, Clayton Street West, Newcastle-upon-Tyne.

W. A. Carter, 32, Abbeville Road, Clapham, London, S.W.4, electrical engineer, lately carrying on business at 95, Hambalt Road, Clapham, S.W.4.—Receiving order made 27th June on a creditor's petition.

K. R. Andrews, lately carrying on business with another under the style of Combined Electrical Services, electricians, at "Deep Purple," Abbey Road, West Moors, Dorset.—Public examination 26th September at the Law Courts, Stafford Road, Bournemouth.

T. E. Jones, trading as Berrington Jones, 138, Northgate Street, Chester, electrical engineer.—Last day for receiving proofs for dividend 16th July. Trustee, Mr. A. K. Ferguson, West Africa House, 25, Water Street, Liverpool, 2.

H. Rose, 158, Soho Road, Handsworth, Birmingham, trading as Rose Electrical Service, electrical contractor and dealer.—Supplemental dividend of 3s 6¼d in the £, payable on and after 19th July at the Official Receiver's office, Somerset House, 37, Temple Street, Birmingham, 2.

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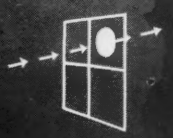

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NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) will be obtainable after 17th July from the Patent Office, 25, Southampton Buildings, London, W.C.2

1952

7614. United Kingdom Atomic Energy Authority.—Nuclear reactors. 25th March, 1952. (779134.)

17746. Telefonaktiebolaget L. M. Ericsson.—Electron tubes. 14th July, 1952. (779189.)

19540. General Electric Co.—Non-emissive grids and methods of preparing same. 1st August, 1952. (779343.)

1953

7527. National Research & Development Corporation.—Piezo-electric resonators. 25th June, 1954. (779403.)

9797. British Thomson-Houston Co., Ltd.—Electric winders. 17th February, 1954. (779140.)

10028. Licentia Patent-Verwaltungs-Ges.—Method of converting the conductivity type of a region of the surface of a semi-conductor body. 13th April, 1953. (779190.)

14785. Celestin, W. E.—Process and apparatus for transmitting and receiving visual images electronically. 27th May, 1953. (779141.)

20103. I-T-E Circuit Breaker Co.—Regulator for mechanical rectifier. 20th July, 1953. (779346.)

23029 and 24077. Sylvania Electric Products, Inc.—Electroluminescent lamps. 20th and 31st August, 1953. (778905/6.)

31883. General Electric Co.—Semi-conductor devices. 17th November, 1953. (779146.)

32990. Kelvin & Hughes, Ltd.—Electric control systems. 29th November, 1954. (779193.)

36395. Sylvania Electric Products, Inc.—Method of and apparatus for exhausting and filling electric gaseous discharge devices. 31st December, 1953. (779055.)

1954

3657. Metropolitan-Vickers Electrical Co., Ltd.—Power plant including a nuclear reactor. 4th February, 1955. (778941.)

4036. Cinema-Television, Ltd.—Frequency monitoring apparatus. 11th February, 1955. (779233.)

5006. General Electric Co., Ltd., and Fairbairn, E. P.—Radio station receiving apparatus. 17th February, 1955. (779012.)

7327. British Thomson-Houston Co., Ltd.—Hermetically sealed barrier-layer rectifiers. 11th March, 1955. (Addition to 749030.) (779195.)

8202. Automatic Telephone & Electric Co., Ltd.—Selecting arrangements. 28th February, 1955. (779151.)

10498. Cinema-Television, Ltd.—Electrical frequency determining apparatus. 7th April, 1955. (779234.)

11138. Automatic Telephone & Electric Co., Ltd.—Telephone systems. 5th April, 1955. (779235.)

12479. Marconi's Wireless Telegraph Co., Ltd.—Inductance devices. 28th March, 1955. (778956.)

13670. United Kingdom Atomic Energy Authority.—Nuclear reactors. 3rd May, 1955. (779408.)

16253. British Broadcasting Corporation.—Measurement of alternating electric currents. 31st May, 1955. (779016.)

16709. Automatic Telephone & Electric Co., Ltd.—Mounting arrangements for small electrical components. 6th June, 1955. (779260.)

17084. Fernseh Ges.—Methods of testing deflection linearity in cathode-ray tube apparatus. 10th June, 1954. (779410.)

17905/6. Reyrolle & Co., Ltd., A.—High-voltage electric circuit-breakers. 15th September, 1955. (778908/9.)

23114. Parsons & Co., Ltd., C. A.—Gas turbine plants with heat exchangers. 19th July, 1955. (779265.)

23124. Electrothermal Engineering, Ltd.—Flexible electrical heaters. 9th August, 1955. (779266.)

27001. English Electric Co., Ltd.—Electrical instruments or relays. 16th September, 1955. (778959.)

28781. Lightfoot Refrigeration Co., Ltd.—Compression refrigerating plants. 6th October, 1955. (778961.)

29301. Mullard Radio Valve Co., Ltd.—Circuit arrangements for providing a stabilised d.c. output. 23rd September, 1955. (Cognate application 1514, 18th January, 1955.) (779162.)

29411. General Electric Co., Ltd.—Impulse operated electric switching means. 12th October, 1955. (779272.)

29520. Brush Electrical Engineering Co., Ltd.—Alternator control systems. 13th October, 1954. (779273.)

30178. Marconi's Wireless Telegraph Co., Ltd.—Frequency responsive circuit arrangements. 13th July, 1955. (779274.)

30548. General Electric Co., Ltd.—Electric welding apparatus. 14th October, 1955. (778963.)

30688. General Electric Co.—Gas turbine power plant and control system therefor. 25th October, 1954. (779164.)

30770. Automatic Telephone & Electric Co., Ltd.—Telephone systems. 12th September, 1955. (779414.)

31666. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Carrier wave transmission systems for television signals. 2nd November, 1954. (779019.)

34706. Federal Pacific Electric Co.—Automatic electric circuit-breakers. 30th November, 1954. (778952.)

34823. Associated Electrical Industries, Ltd.—Electrostatic apparatus. 18th November, 1955. (778923.)

35970. Specialties Development Corporation.—Self-resetting electrical network automatically responsive to a condition. 13th December, 1954. (779282.)

37415. Sebel Soc. Anon.—Electronic fluorescent illuminating lamp. 24th December, 1954. (Addition to 749448.) (779167.)

1955

129. Robertshaw-Fulton Controls Co.—Temperature responsive electric control devices. 3rd January, 1955. (779168.)

450. Philips Electrical Industries, Ltd.—Carrier-wave signal transmission systems. 6th January, 1955. (779287.)

861. Telegraph Construction & Maintenance Co., Ltd.—Cable laying apparatus. 6th January, 1956. (779286.)

990. British Thomson-Houston Co., Ltd.—Cathodes for electric discharge devices. 29th December, 1955. (779095.)

1548. Hall, Ltd., J. & E.—Electric lift systems. 7th November, 1955. (778965.)

1678. Oldham & Son, Ltd., and Prout, L. R.—Manufacture of plates for lead acid batteries. 19th January, 1956. (779205.)

2223. Stone-Chance, Ltd.—Synchronising of electrical apparatus. 12th December, 1955. (779416.)

2882. Duckham, W. G.—Means for electrically heating saucepans, frying pans and other vessels. 31st January, 1955. (779207.)

3779. Staatsbedrijf der Posterijen, Telegrafie en Telefonie.—Regenerative repeaters comprising a double memory for signals in a start-stop-code. 8th February, 1955. (779370.)

4152. Philips Electrical Industries, Ltd.—Circuit arrangements for controlling gas or vapour-filled discharge tubes. 11th February, 1955. (779024.)

4476. Standard Telephones & Cables, Ltd. (International Telephone & Telegraph Corporation).—Aircraft navigation radio beacon receiver circuits. 15th February, 1955. (779171.)

4551. Svenska Relafabriken Aktiebolag.—Telephone systems and the like. 15th February, 1955. (779172.)

5964. Compagnie Générale de Télégraphie sans Fil.—Multiple decoupling condenser for electron tubes. 28th February, 1955. (779099.)

7156. Automatic Telephone & Electric Co., Ltd.—Measuring circuits for the quality factor (Q) of coils. 23rd November, 1955. (779174.)

7390. British Thomson-Houston Co., Ltd.—Electrical equipment employing contact brushes. 29th February, 1956. (779378.)

7943. General Electric Co.—Electroluminescent cell and a method of preparing same. 18th March, 1955. (779300.)

9021. Svenska Ackumulator Aktiebolaget Jungner.—Electric storage cells. 28th March, 1955. (778930.)

10897. Westinghouse Electric International Co.—Control systems for electric generators. 15th April, 1955. (779382.)

11853. International Business Machines Corporation.—Method of growing semi-conductors. 25th April, 1955. (779383.)

12819. Bochumer Verein für Gusstahlfabrikation Akt.-Ges.—Direct electrical resistance heating of metallic bodies. 3rd May, 1955. (778977.)

13271. Automatic Telephone & Electric Co., Ltd.—Multi-channel phase modulated carrier transmission systems. 7th May, 1955. (778978.)

14608. Brentford Electric, Ltd.—Reversible heat pumps. 20th May, 1955. (779214.)

17064. Westinghouse Electric International Co.—Switching circuits incorporating transistors. 14th June, 1955. (779217.)

18197. Siemens & Halske Akt.-Ges.—Processes and apparatus for incorporating donor and/or acceptor impurities in semiconductor elements. 23rd June, 1955. (779179.)

18230. Licencia Talalmanyokat Ertekesito Vallalat.—Electric tumbler switches. 23rd June, 1955. (778932.)

18715. Sylvania Electric Products, Inc.—Matrices for switching purposes. 28th June, 1955. (779422.)

22160. Naamlooze Vennootschap Fabriek Van Electrische Apparaten Voorheen F. Hazemeijer & Co.—Insulation clad electric circuit-breaker of limited breaking power. 2nd August, 1955. (779103.)

22184. Maxson Corporation, W. L.—Snap-switch. 2nd August, 1955. (779424.)

24588. Ransburg, H. J., Ransburg, H. G., Ransburg, H. P., and Ransburg, E. M. (trading as Ransburg Co., H. J.).—High voltage apparatus. 26th August, 1955. (778984.)

25282. Creed & Co., Ltd.—Facsimile telegraph scanning apparatus. 2nd September, 1955. (778985.)

25930. Siemens & Halske Akt.-Ges.—Armatures for polarised electromagnetic devices. 9th September, 1955. (779429.)

28111. General Electric Co.—Temperature controlled surface heating units. 3rd October, 1955. (778937.)

28628. Eaton Manufacturing Co.—Sealing means for an electromagnetic apparatus and apparatus equipped with such sealing means. 7th October, 1955. (779432.)

29074. Philips Electrical Industries, Ltd.—Inductance coils. 12th October, 1955. (779044.)

29218. Carpenter, H. G.—Electric torch with auxiliary external circuit connector. 13th October, 1955. (779106.)

29390. Collins Radio Co.—Magnetic commutator system for space distributing pulses received in time distribution. 14th October, 1955. (779433.)

[*Concluded on next page*

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Brierley Hill.—U.D.C. 19th July. 140 W sodium discharge lamps and 25ft concrete columns. Surveyor, Civic Buildings.

Burma.—Union of Burma Purchase Board. 24th July. Electric fork lift trucks. (E.S.B. 16506/57. Ten/26743.)* Insulators. (E.S.B. 16507/57. Ten/26744.)* 29th July. Three 15 h.p. squirrel cage motors. (E.S.B. 16509/57. Ten/26738.)*

Canada.—City of Winnipeg. 22nd July. Two 5,000/6,667 kVA and two 5,625/7,500 kVA transformers. (E.S.B. 16340/57. Ten/26813.)*

Down.—County Education Committee. 25th July. Electrical installation in Drumbo (New) Primary School, Lisburn. Ian Hunter & Partners, consulting engineers, 21, Botanic Avenue, Belfast.

Formosa.—Central Trust of China, Taipei. 23rd July. Electric cable and capacitors. (E.S.B. 15887/57. Ten/26615.)* 25th July. One 20 h.p. and two 200 h.p. motors, and indoor switchboards. (E.S.B. 15890/57. I.C.A. Ten/26614.)* 26th July. Ammeters, voltmeters, cathode ray tubes, microscopes. (E.S.B. 16182/57.I.C.A. Ten/26686.)* 30th July. Electric motors, electric furnace and mining cable. (E.S.B. 16191/57.I.C.A. Ten/26685.)*

Greece.—Ministry of Finance. 23rd July. Radio valves. (E.S.B. 16611/57. Ten/26822.)*

India.—Director General of Supplies & Disposals, New Delhi. 26th July. Electric cable. (E.S.B. 16081/57. Ten/26633.)*

Damodar Valley Corporation, Calcutta. 29th July. Galvanised steel wire and accessories. (E.S.B. 15698/57. Ten/26634.)* 20th August. 132 kV and 33 kV insulators. (See this issue.)

Iraq.—Directorate General of Municipalities, Baghdad. 27th July. Electrical equipment for Sulaimaniyah power station. (E.S.B. 16169/57. Ten/26701.)* Five 100 kVA transformers. (E.S.B. 16229/57. Ten/26700.)*

Posts and Telegraphs, Baghdad. 15th August. Double diversity receivers and associated equipment. (E.S.B. 15510/57. Ten/26711.)*

Lanarkshire.—County Council. 31st July. Street lighting equipment. (See this issue.)

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

Morley.—Corporation. 29th July. Street lighting equipment. (See this issue.)

New Windsor.—Borough Council. 14th August. Electrical installations in 30 houses to be erected at Burnetts Road, Dedworth. Borough engineer, Kipling Building, Alma Road, Windsor.

New Zealand. — Dunedin Corporation Electricity Department. 17th July. Aluminium conductors and accessories. (E.S.B. 16219/57. Ten/26705.)* 26th July. Paper insulated electric cable. (E.S.B. 16217/57. Ten/26695.)* Bare and p.v.c. insulated copper cable. (E.SB. 16218/57. Ten/26709.)*

Christchurch Municipal Electricity Department. 6th August. Bare aerial copper cable. (E.S.B. 16242/57. Ten/26694.)* Weatherproof aerial cable. (E.S.B. 16241/57. Ten/26693)*

Pakistan.—Directorate-General, Posts and Telegraphs. 20th July. Air conditioning equipment for telephone exchange. (E.S.B. 16738/57. Ten/26797.)*

Philippines.—National Power Corporation, Manila. 12th September. Hydro-electric plant including two 580 h.p. turbines, two 500 kVA generators, one 1,000 kVA transformer, switchgear and station service equipment for Amlan River hydro-electric project. (E.S.B. 15796/57. Ten/26616.)*

South Africa.—Union Tender & Supplies Board, Pretoria. 18th July. Two electric furnaces. (E.S.B. 16063/4/57. Ten/26638/9.)*

Durban Telephone Department. Telephone switchboards. (E.S.B. 16151/57. Ten/26666.)*

Stores Department, South African Railways, Johannesburg. 26th July. Insulators. (E.S.B. 15953/57. Ten/26620.)*

Staines.—U.D.C. 25th July. Tubular steel columns, dismantling of existing equipment and supply of lanterns and fittings, Class "A" lighting scheme, Ashford shopping centre. Surveyor, 240, London Road, Staines.

Sudan.—Posts and Telegraphs, Khartoum. 31st July. Copper and cadmium copper wires. (E.S.B. 15992/57. Ten/26623.)*

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Hove.—Multi-storey office block for Alliance Building Society; Jackson & Greenen, architects, Hinton Buildings, Hinton Road, Bournemouth.

Huddersfield.—Extensions and alterations to central premises (£100,000), for Y.M.C.A.; secretary, John William Street.

Leicester.—Rocket Hotel, New Parks estate; Pick, Everard, Key & Gimson, architects, 6, Millstone Lane.

London.—Factory, Sheep Lane, Hackney; L. Morris, Ltd., 14, Regent's Row, E.8.

Eight-storey block of 44 flats, High Street South, East Ham; borough engineer.

Extensions, Brook House, Shooters Hill; South East Metropolitan Regional Hospital Board, 9, Hallam Street, W.1.

Flats (55), shops (14), offices and commercial garage, Berwick Street/Hopkins Street scheme, for Westminster City Council; Riches & Blythin, architects, 16, Northumberland Avenue, London, W.C.2.

Maidenhead.—Municipal buildings on central car park site; North & Partners, architects, 40, The Broadway.

Manchester.—Works extensions; Selas Gas & Engineering Co., Ltd., Selas Works, City Road, Hulme.

Merthyr Tydfil.—Houses (225), Gurnos; borough engineer, Town Hall.

Middlesbrough.—Accident and orthopædic departments at General Hospital (£320,660); Newcastle Regional Hospital Board, Osborne Road, Newcastle.

Middlesex.—Erection of 16 fire stations in the county; county architect, 1, Queen Anne's Gate Buildings, London, S.W.1.

Morley.—Houses (100), at Moorhead, Gildersome; borough engineer, Town Hall.

Newcastle-on-Tyne. — Three-storey flats, Walker Back Road, etc.; G. Kenyon, city architect, 18, Cloth Market, Newcastle.

Laboratory block at the Church High School; Newcombe & Newcombe, architects, 23, Eldon Square, Newcastle.

Northumberland.—Grammar school, Ashington; county architect, County Hall, Newcastle-on-Tyne.

Pembrokeshire.—County primary infants' school at Hakin; county architect, County Offices, Haverfordwest.

Pontypool.—Houses (106), Kemys Fawr estate; U.D.C. surveyor, Town Hall, or architect, Market Buildings.

Prestatyn.—Ffrith Hotel, Ceg-y-Fford, Rhoslan; Sir Alfred Shennan & Partners, architects, 17, North John Street, Liverpool.

Smethwick. — Aged persons' flats (40), Lyttleton Hall estate; E. L. Twycross, town clerk, Town Hall.

South Shields.—Houses (104), Whiteleas estate; J. Reid, borough engineer, Town Hall.

Torpoint.—Reconstruction of workshops, stores and garages at Union Road depot (£9,000); U.D.C. surveyor, Council Offices, York Road.

Tynemouth. — Factory, Low Flatworth Farm, for Hodges-Brown and Co., Ltd.; J. G. Cowe and Son, architects, Claremont Place, Newcastle-on-Tyne.

Walsall.—Extensions for Walsall Lithographic Co., Ltd., Wednesbury Road; Lavender, Son & Close, architects, 50, Bradford Street.

West Cumberland. — New hospital (£340,000); Newcastle Regional Hospital Board, Osborne Road, Newcastle.

Wisbech.—Houses (46), Staith Field; borough surveyor, Exchange Square.

Wolverhampton.—Central dental clinic, Redhill Street; borough engineer, Town Hall.

Worthing.—Erection of winter garden on Pier Pavilion (£28,000) and Davison Secondary Girls' School; town clerk, Town Hall.

York.—Re-development of the Ousegate/Spurriergate area by erection of arcade of shops (£80,000); Albemarle Property Co., Ltd., 40, South Audley Street, London, W.1.

NEW PATENTS *(continued from preceding page)*

29910. Maschinenfabrik Oerlikon.—Rectifier installation. 19th October, 1955. (778989.)

31182. Standard Telephones & Cables, Ltd.—Electric attenuation measuring apparatus. 1st November, 1955. (779046.)

32637. Amici, F., Amici, F., and Amici, G.—Reversing switch for machine tool driving motors. 15th November, 1955. (779185.)

34174. Compagnie Française Thomson-Houston.—Position indicator systems. 29th November, 1955. (779436.)

34181. Sylvania Electric Products, Inc.—Apparatus for making grids for electron discharge tubes. 29th November, 1955. (779047.)

34788. General Electric Co.—Cooking appliances. 5th December, 1955. (778939.)

35602. General Electric Co.—Electrical conductor bars. 12th December, 1955. (779050.)

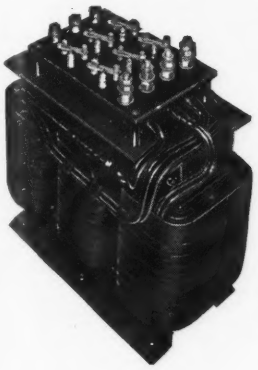
1956

2603. General Motors Corporation.—Household refrigerator. 26th January, 1956. (779327.)

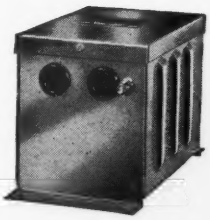
4756. General Electric Co.—Dynamo-electric machines. 15th February, 1956. (779445.)

10544. Wörner, A., and Ersing, M. (trading as Kautt & Bux).—Commutator. 6th April, 1956. (779230.)

HEAYBERD TRANSFORMERS



A typical open type 3-phase transformer.



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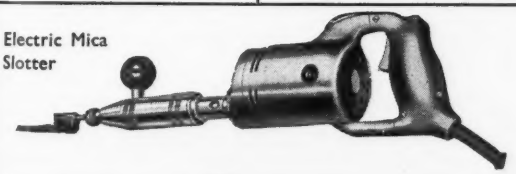
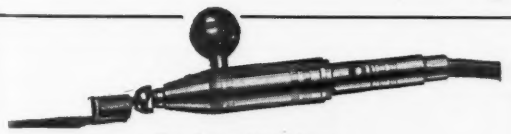
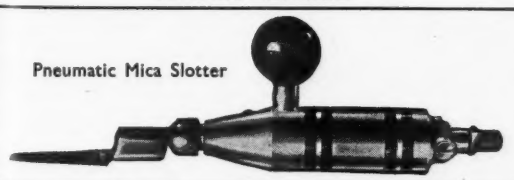




Flex-Drive Mica Slotter

Pneumatic Mica Slotter



With these files and power tools, mica undercutting is a quick and simple process and slots may be cut right up to the risers.

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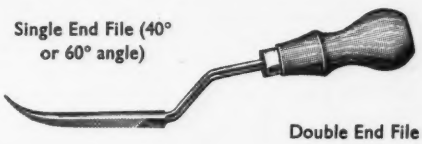
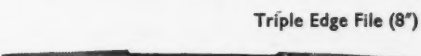


Double End File (6" or 8")

Triple Edge File (8")



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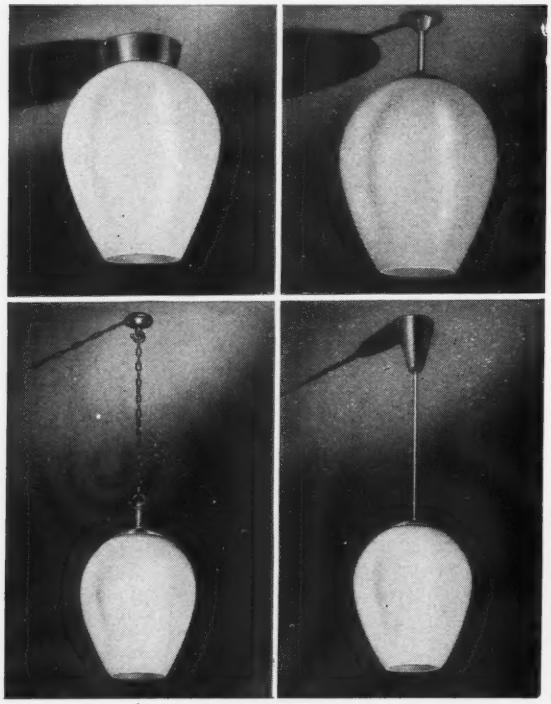

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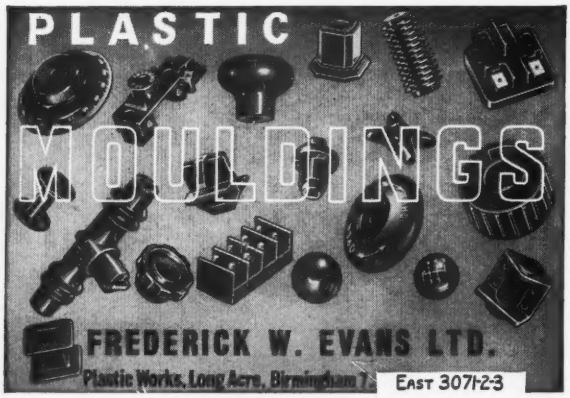

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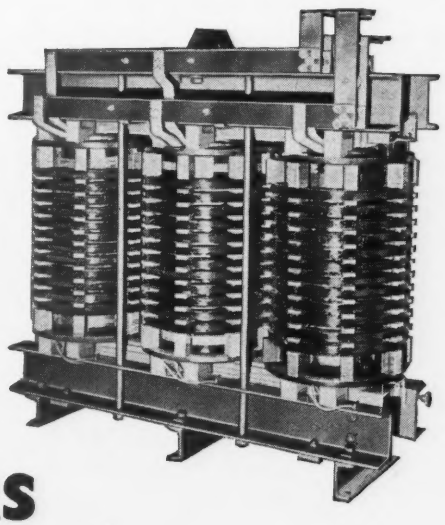

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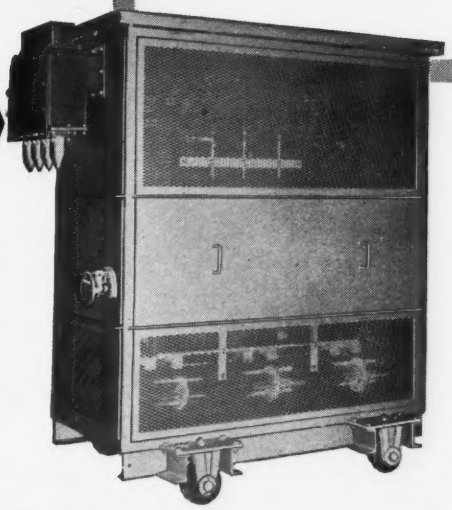
dry type air-cooled Class C

TRANSFORMERS



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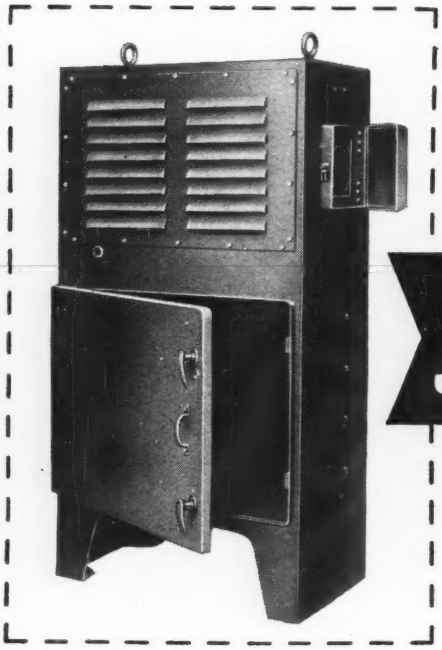

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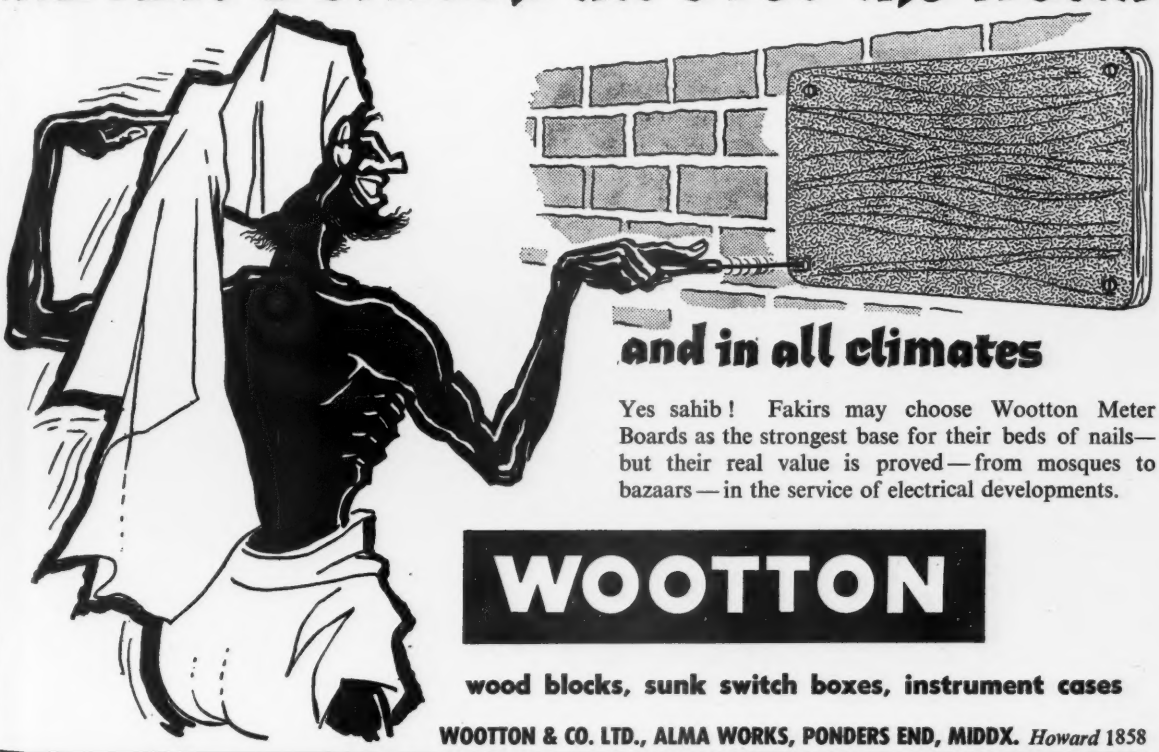

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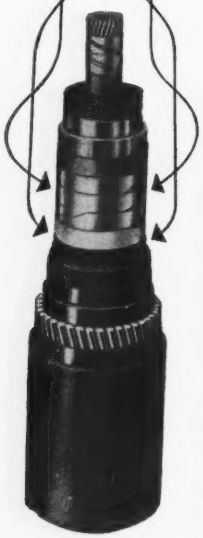

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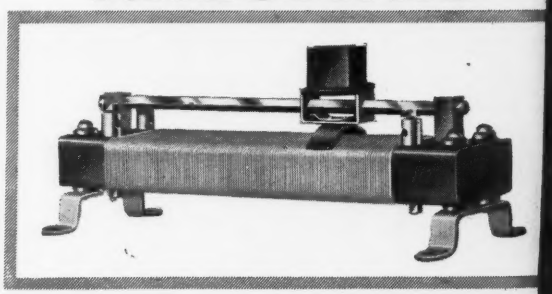

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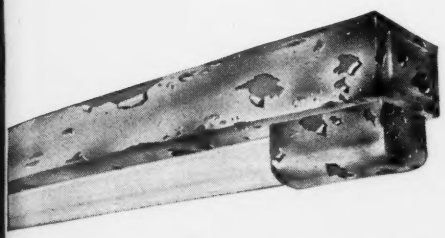

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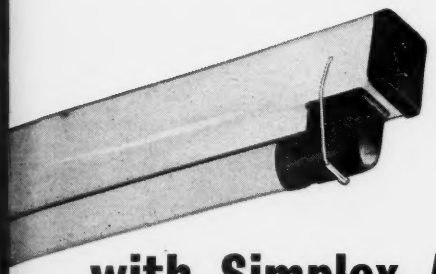

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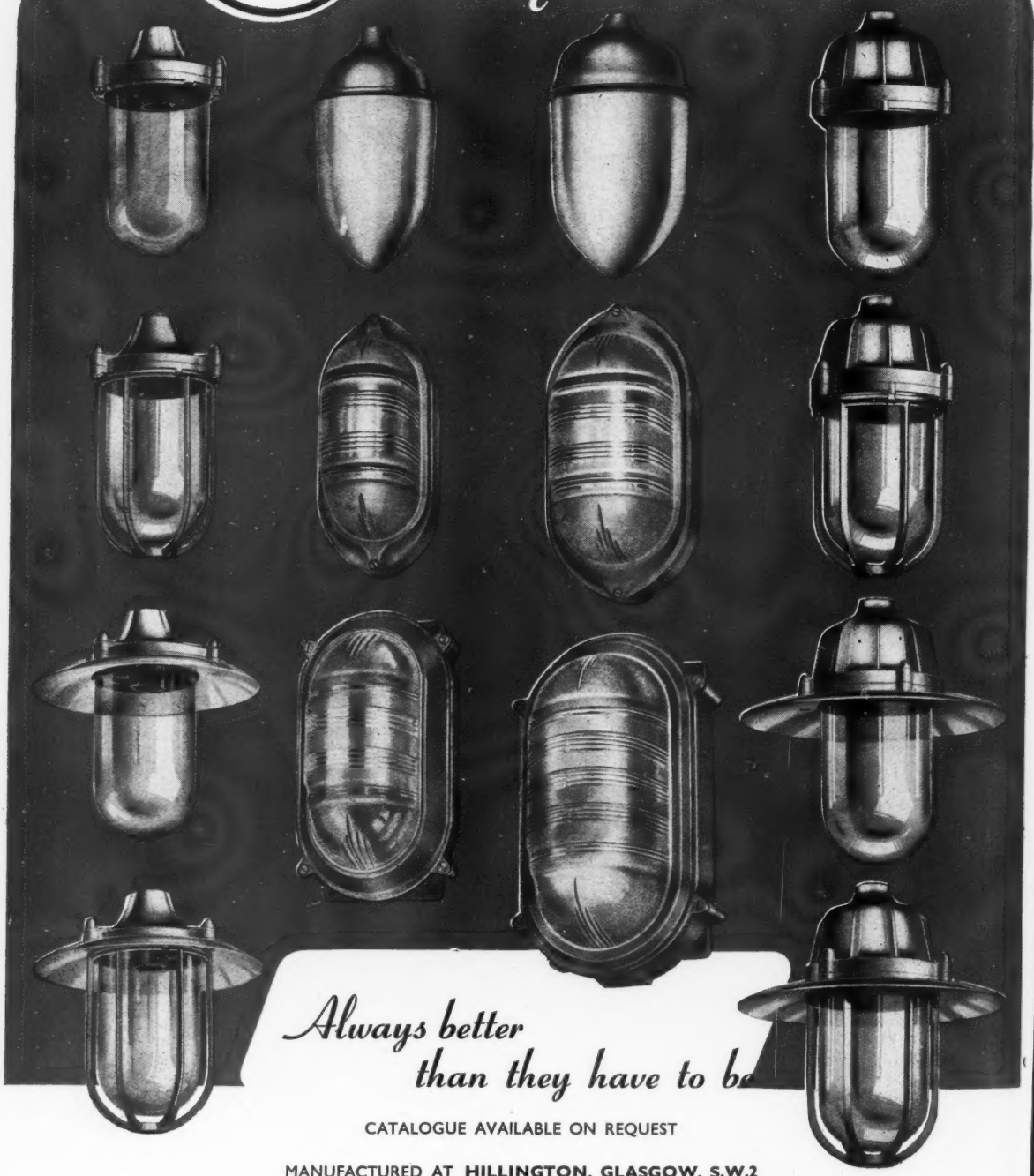

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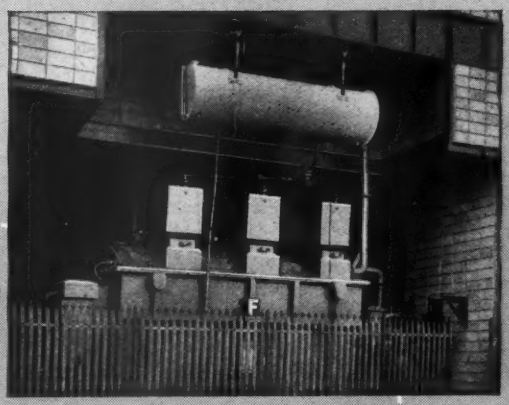

The illustration shows one of the transformers installed at Marchwood Power Station.

FERRANTI TRANSFORMERS for MARCHWOOD POWER STATION

C.E.A. SOUTHERN DIVISION

8 72,000 kVA, 3-phase, 11·8/141·6 kV, OFW, Generator Transformers with On-Load Tap Changing Gear.

4 7,500 kVA, 3-phase, 132/3·42 kV, ON, Station Transformers with On-Load Tap Changing Gear.

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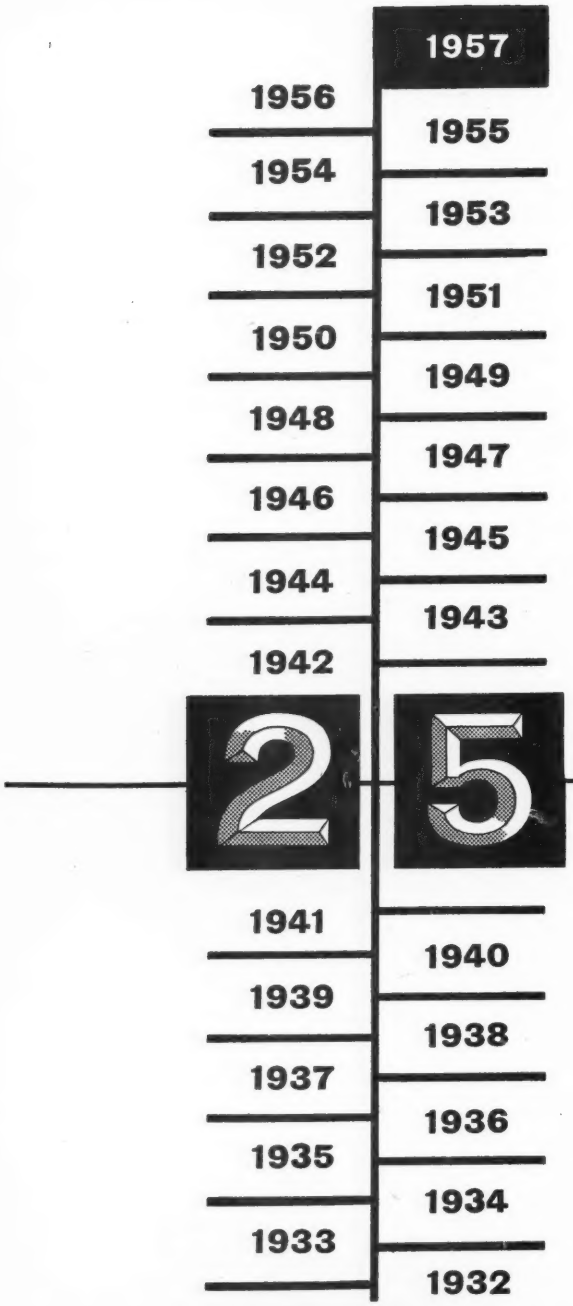

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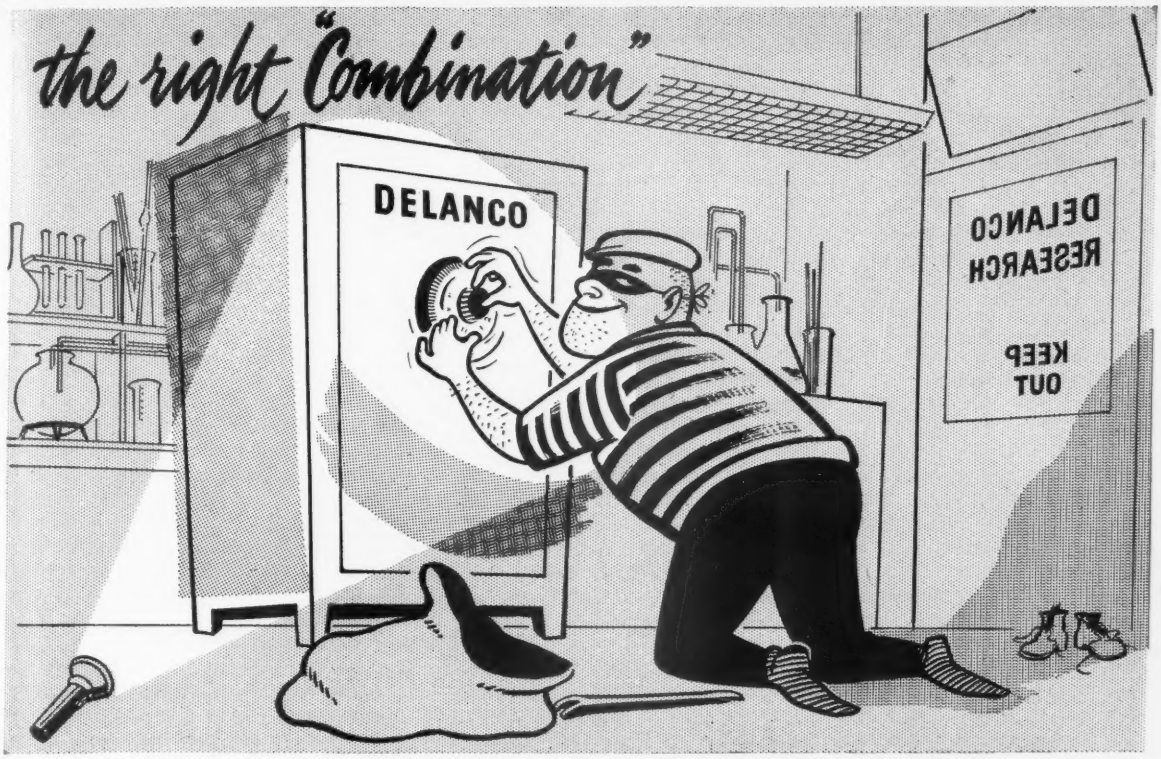

The Gentleman above is getting a preview of the samples of Delanco composite insulations. He needn't have taken all this trouble, as the information on these materials is now available to all in the latest issue of the Delanco catalogue.

Without getting too technical, as all technical details are in the catalogue, we have developed a special range of Delanco composite insulations which are particularly well suited to service in slot lining and similar applications.

Such work requires a material of good mechanical strength, to prevent damage from the edges of the laminations, and of sufficient rigidity to retain its shape against the slot walls during winding.

Furthermore, good electrical strength is required ; this strength must be maintained throughout the life of the machine, and neither heat nor moisture must cause any lowering of electrical values.

These dual requirements, mechanical and electrical, are fully met by the comprehensive "Delanco" range of composite insulations.

You will, of course, be sending for this catalogue and you will find further details on pages 38-39. As with all Delanco materials, the facilities of our technical and research departments are freely available.

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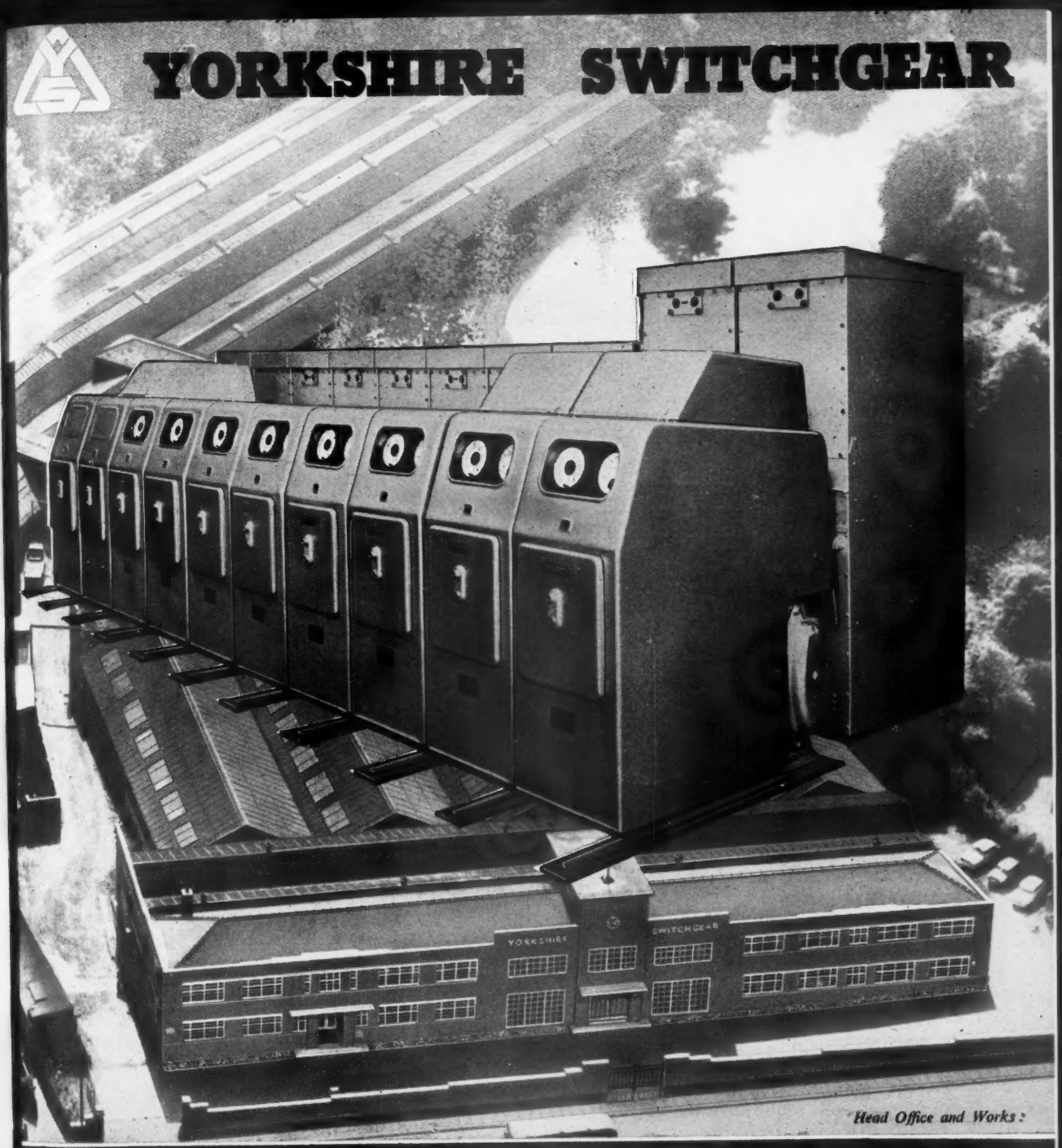

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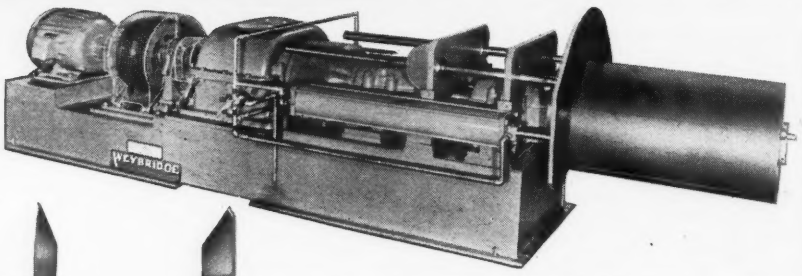

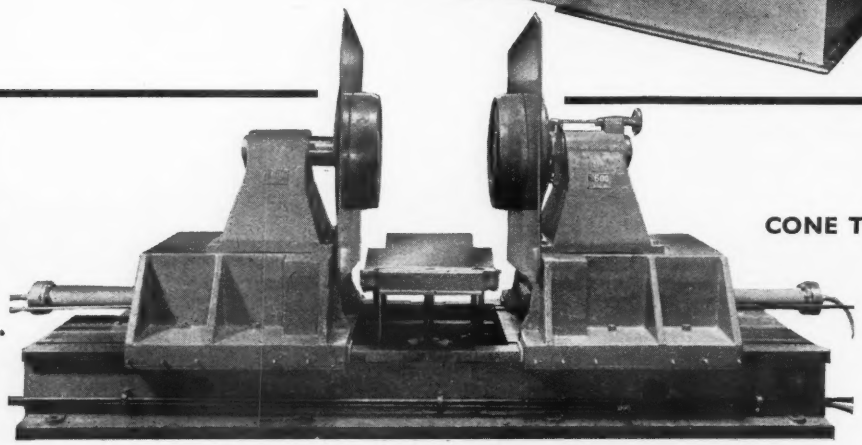

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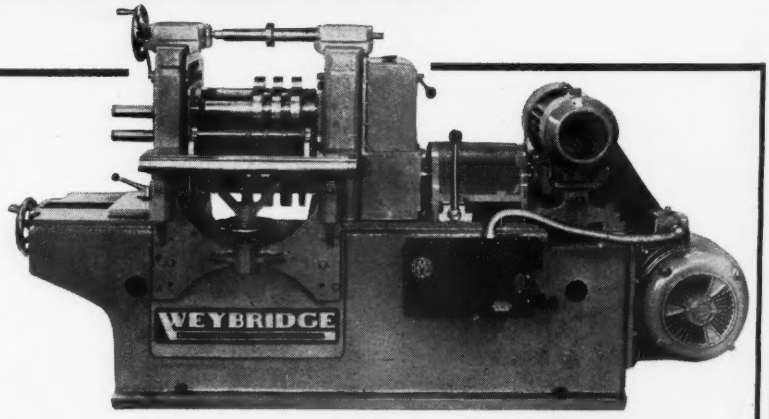

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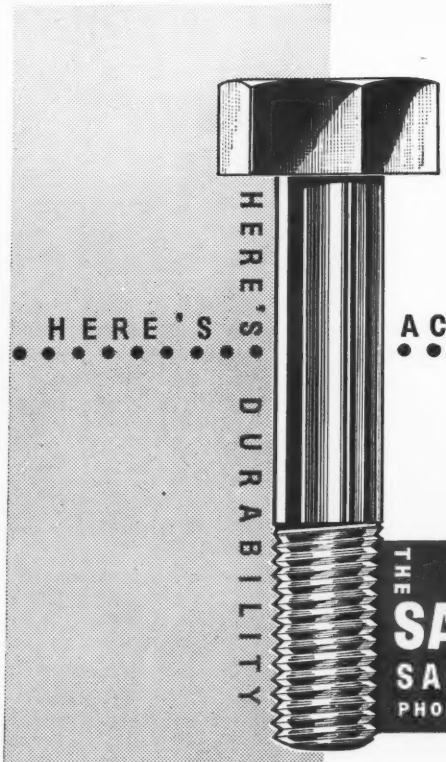

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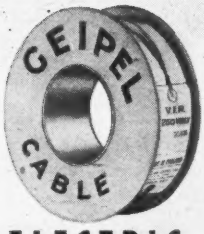

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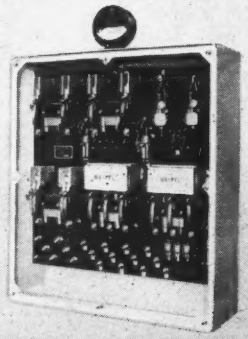

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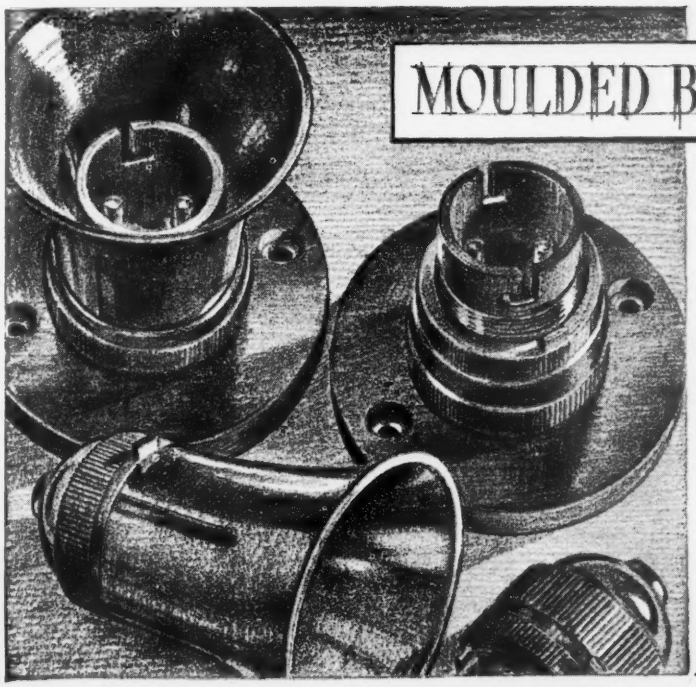

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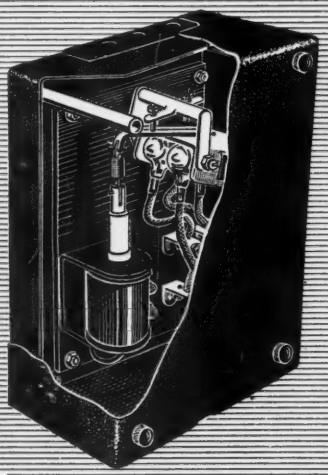


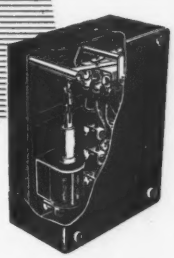
Mercury Switch Relays

TYPE SS

One of the most popular types of mercury switch relay we manufacture, the SS is compact, reliable and adaptable for many and varied contact arrangements.

It is a solenoid operated type with counterbalance, the movement being gravity controlled. The coil can be wound for either A.C. or D.C. circuits. Consumption 6 watts. Mercury switches are made from toughened glass.

Standard types available or to customers' specification, up to 30 amps single pole or 10 amps triple pole 230v.



TYPE MS

Similar in operation to type SS, this general purpose relay is most suitable for situations involving rough usage and heavy overloads of short duration.

Toughened glass mercury switches with fused-in porcelain liners ensure complete freedom from contact troubles throughout life of relay. Coil consumption 8-10 watts.

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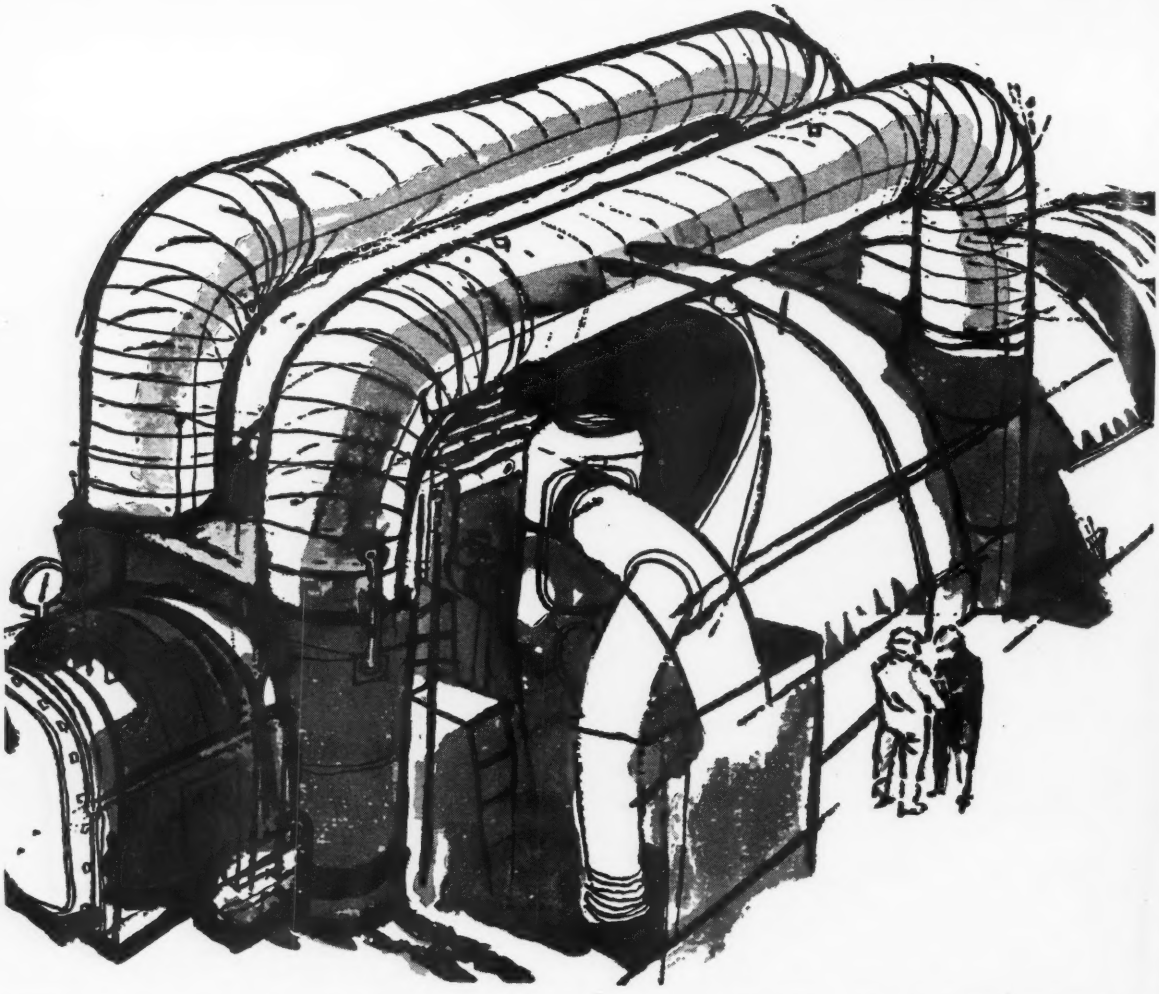

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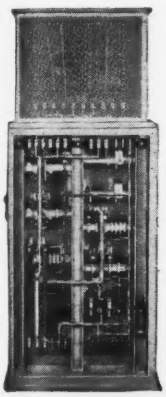
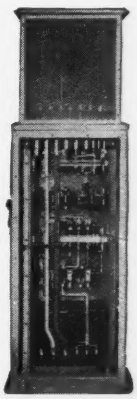
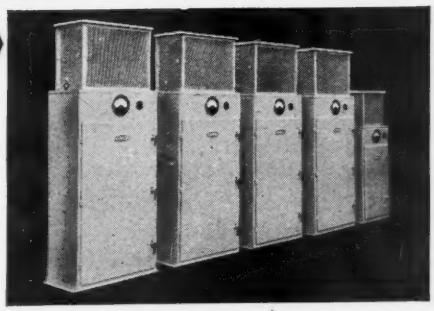


Panel supplied to a large rubber manufacturing firm, to control a 45 H.P. motor for Side-wall Buffing Extraction Process.



Panel supplied to another rubber manufacturer for controlling a 30 H.P. Slip-ring Induction Motor in a laboratory mill.



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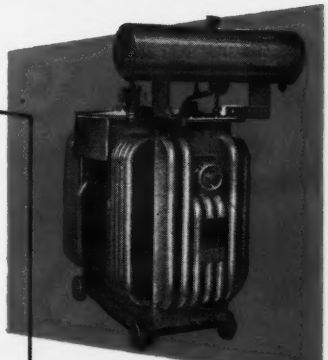

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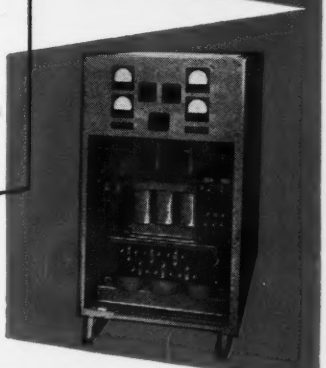

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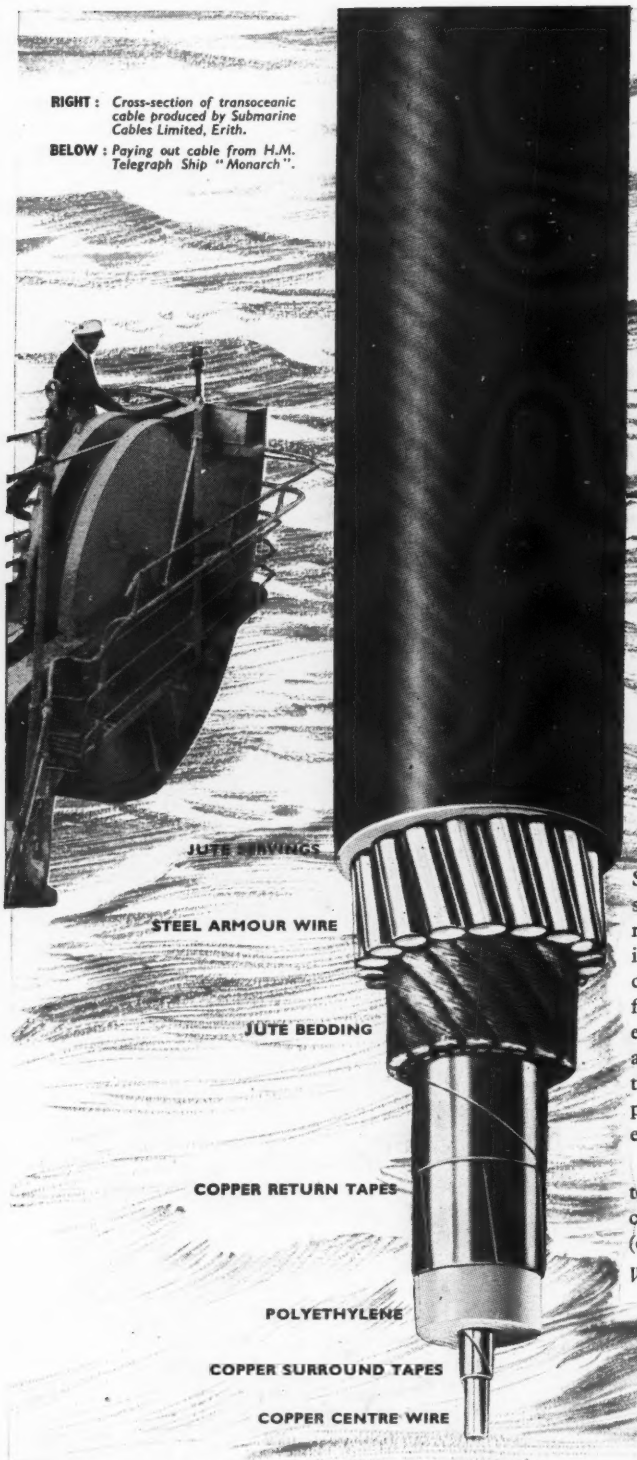

RIGHT : *Cross-section of transoceanic cable produced by Submarine Cables Limited, Erith.*

BELOW : *Paying out cable from H.M. Telegraph Ship "Monarch".*

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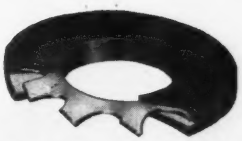

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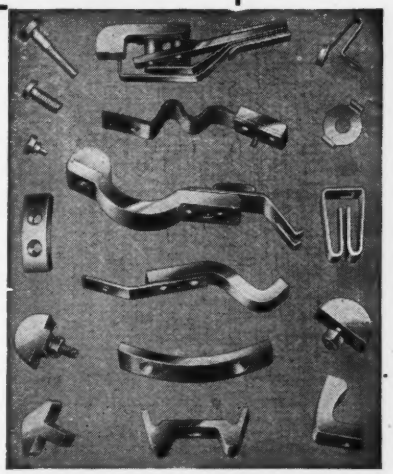

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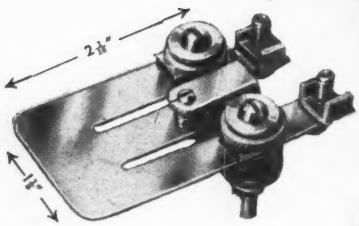

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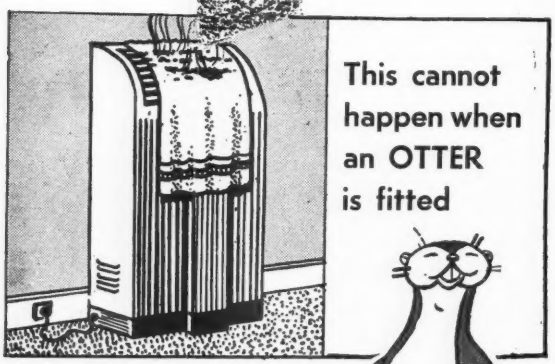

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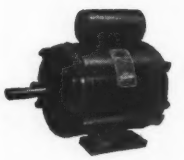

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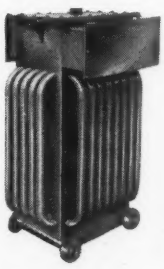

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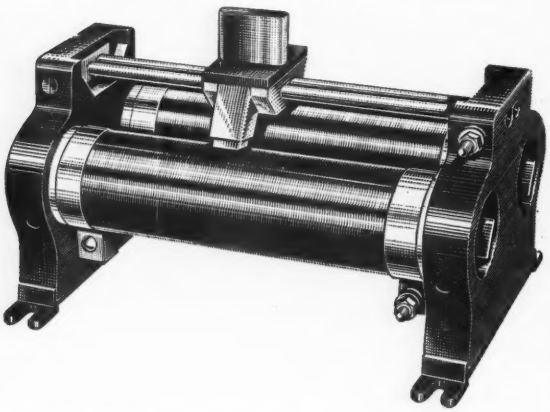

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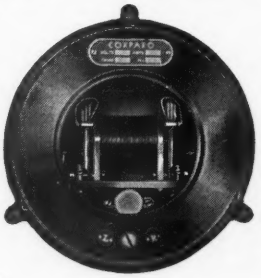

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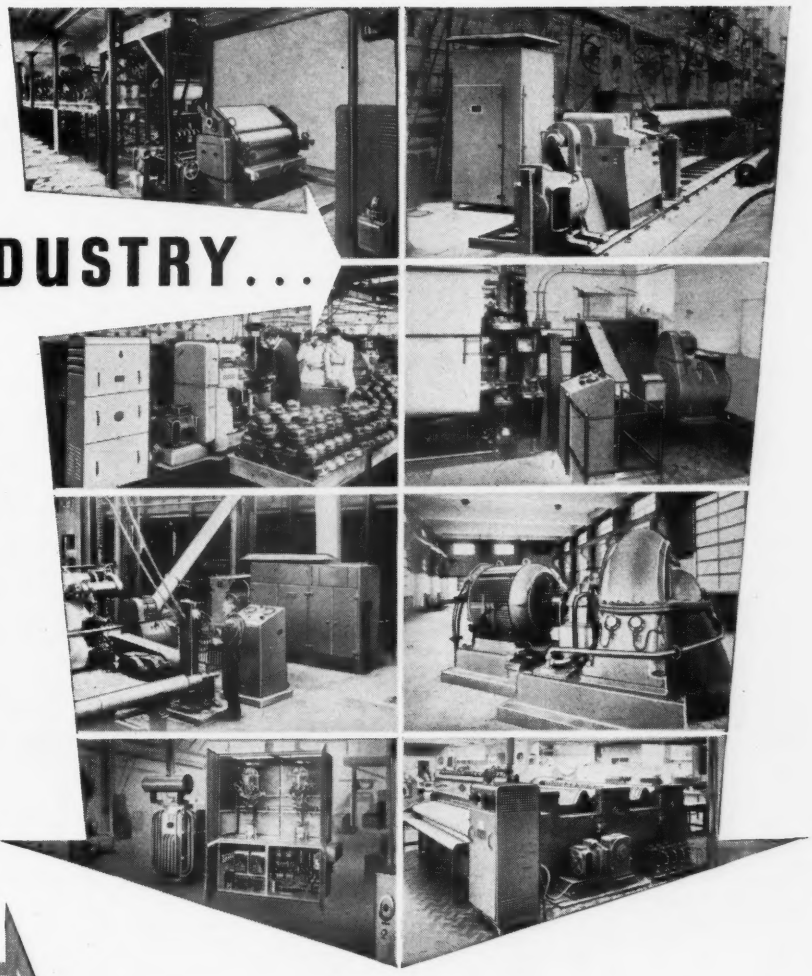

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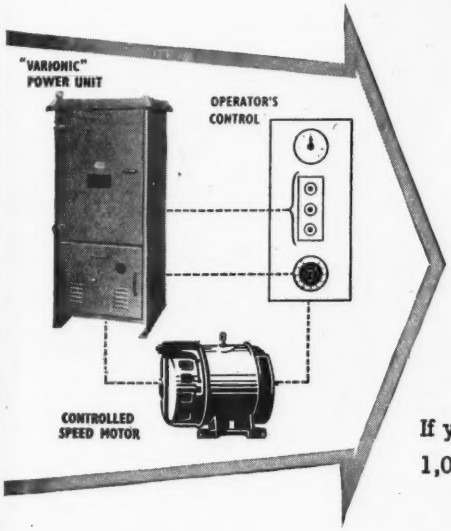

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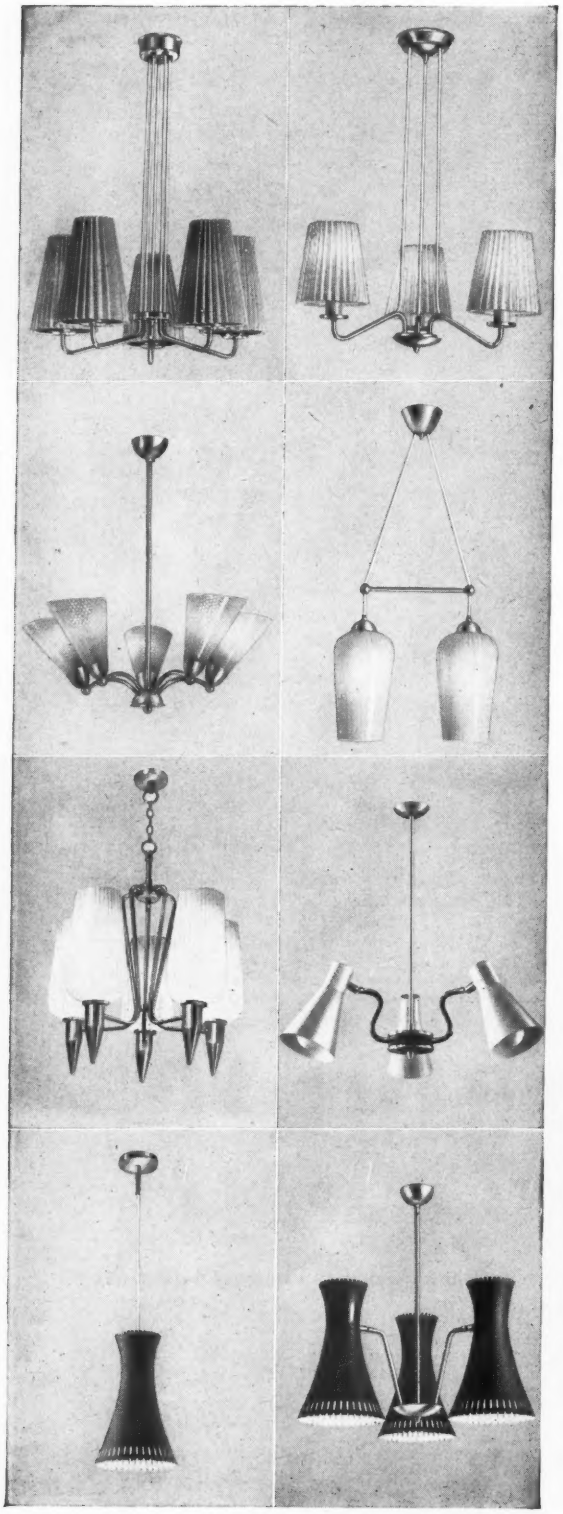

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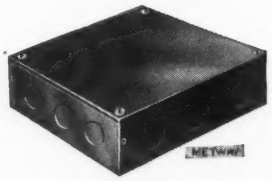

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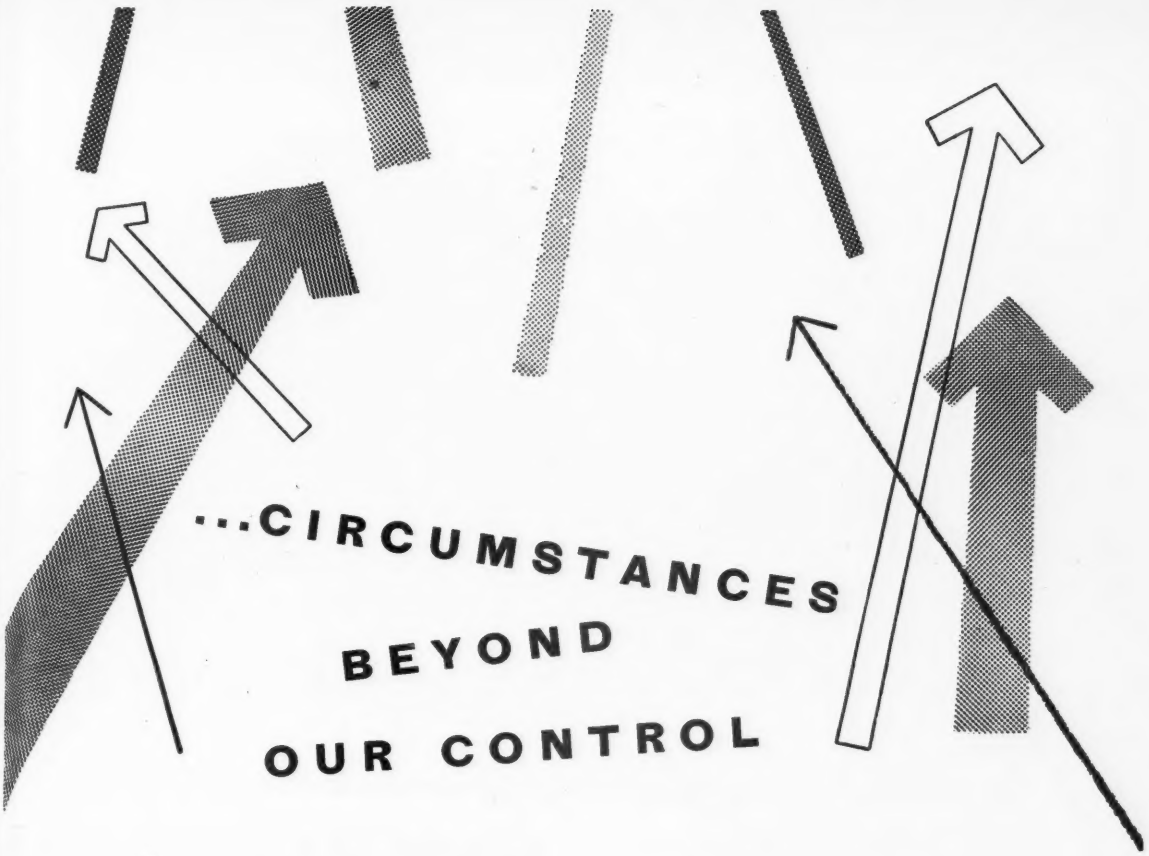

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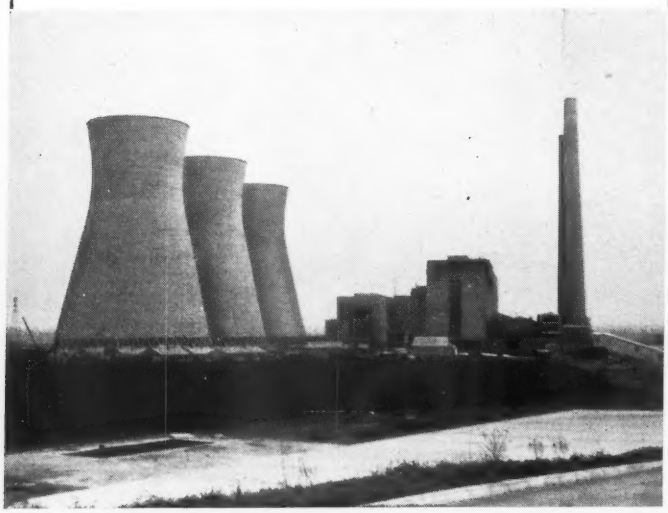

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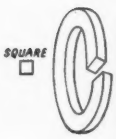

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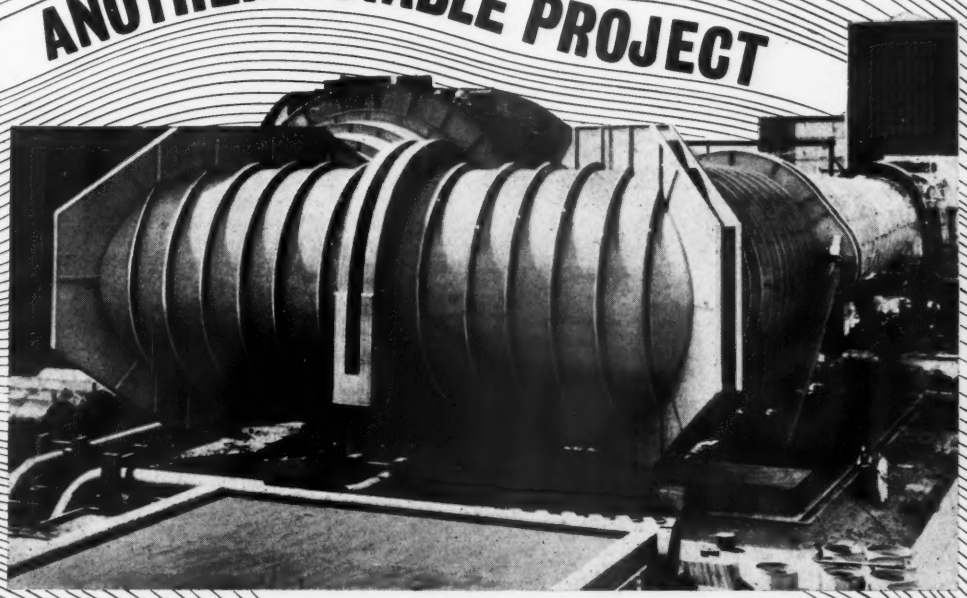

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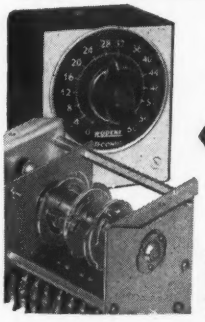

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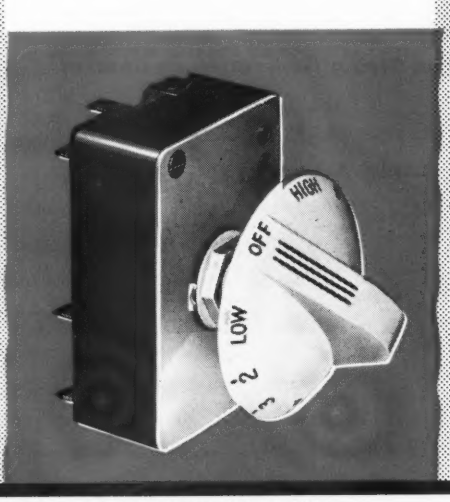

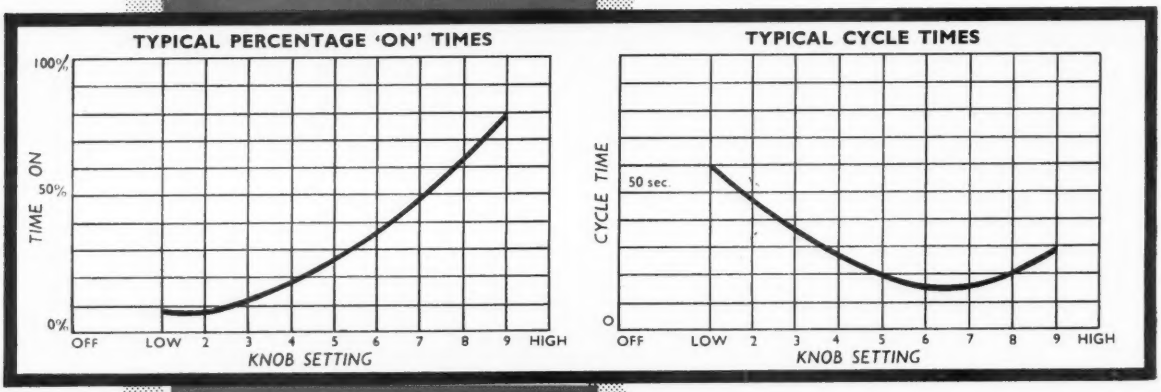

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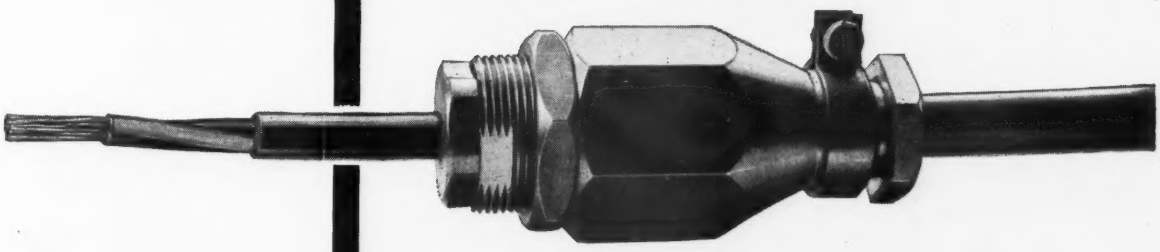

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			PD 428	From 7/044 3 Core to 7/052 4 Core	1"
B603/1	7/044 3 and 4 Core 7/052 Twin, 3 and 4 Core 7/064 Twin, 3 and 4 Core	1½"			
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B604/1	3/029 Twin, 3 and 4 Core 3/036 Twin, and 3 Core 7/029 Twin	¾"			

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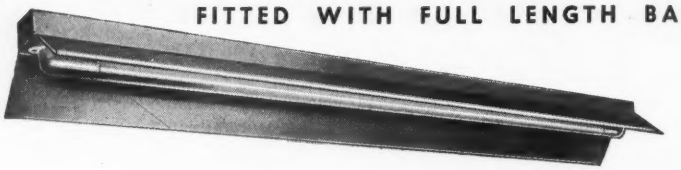

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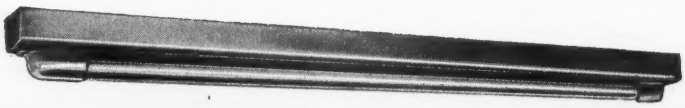

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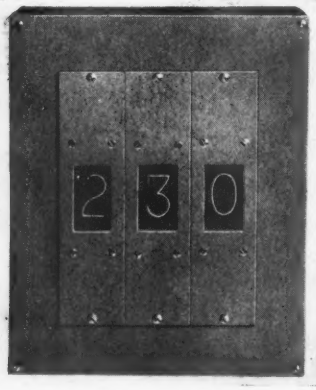

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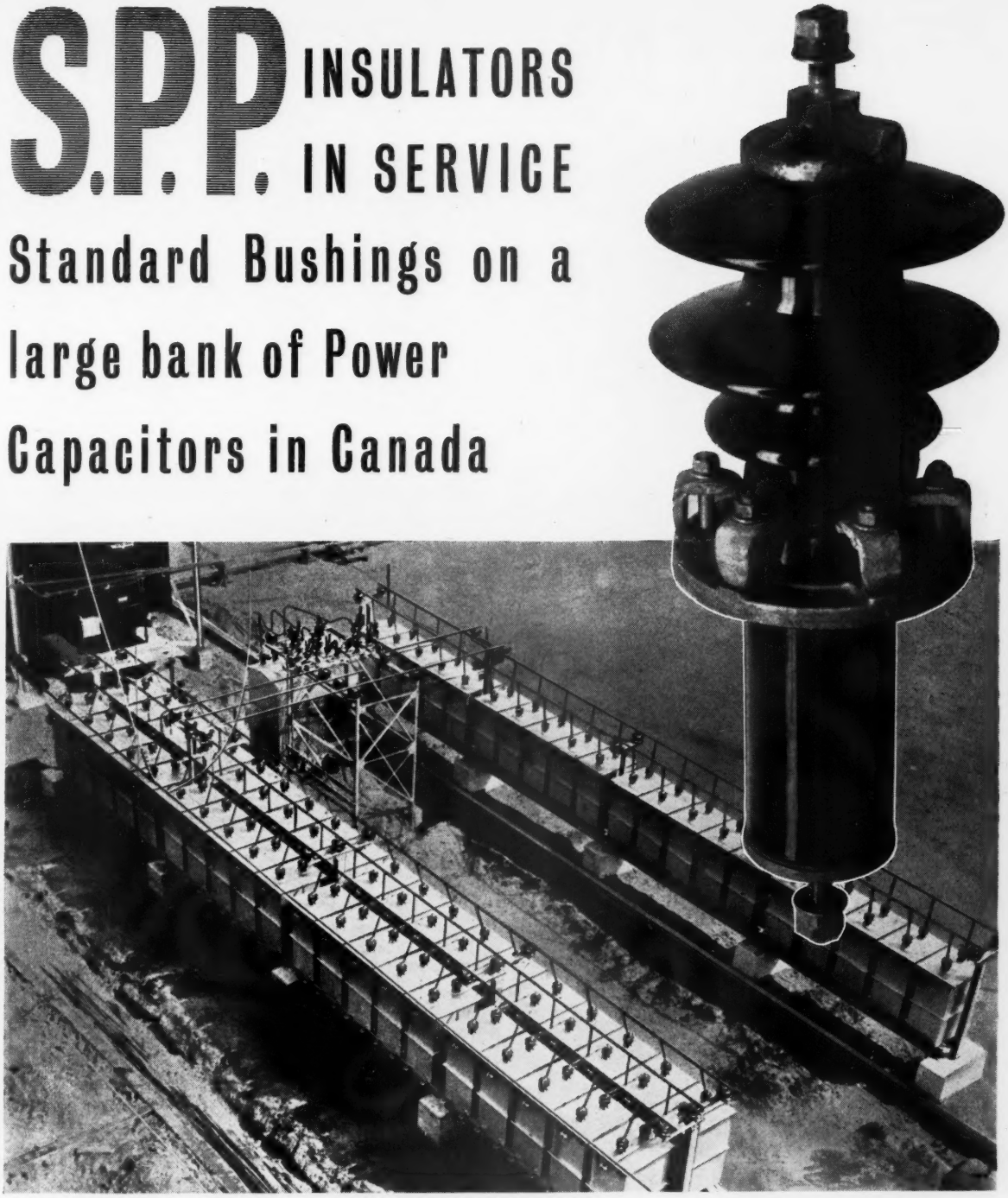

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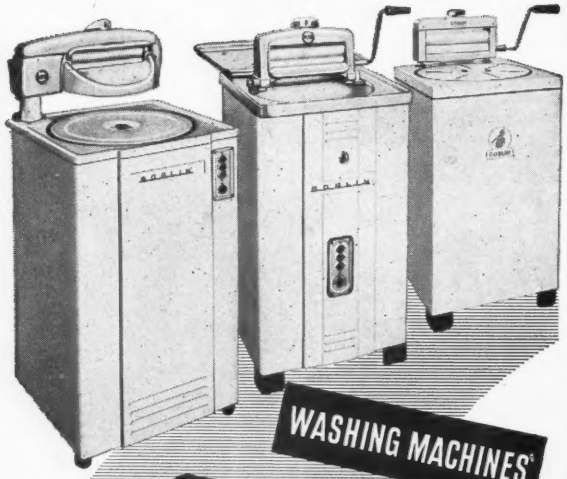

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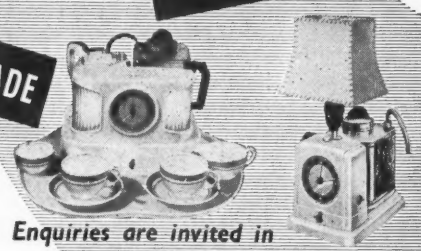

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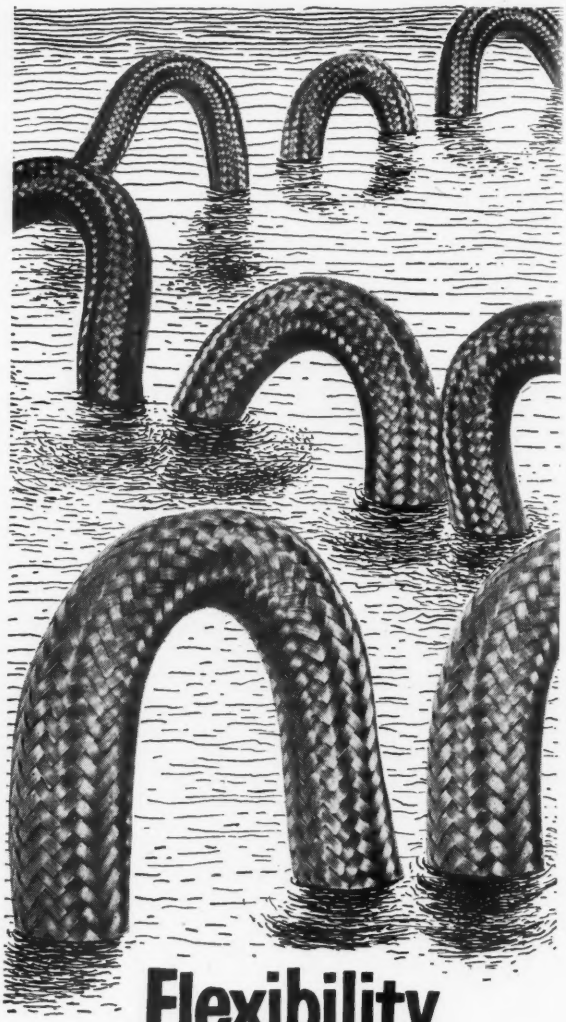

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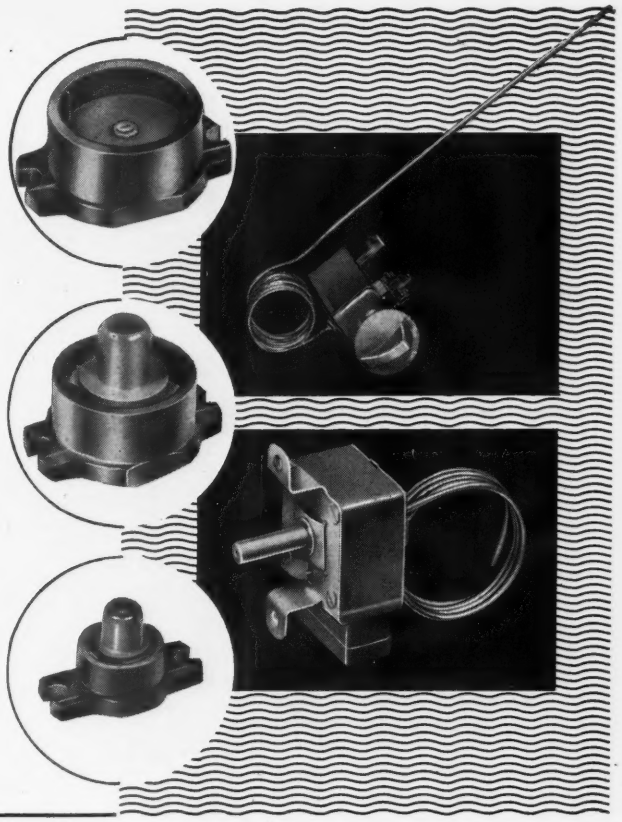

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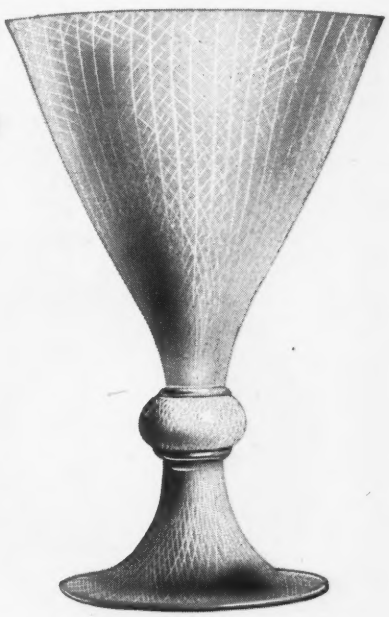
No, we shall not be silly and claim that our castings are as flawless as a piece of 16th century Venetian Glass. But we can go this far: we can say that just as the old master craftsmen got great satisfaction out of doing a job as well as it could possibly be done, so do we. That is why so many customers whose castings must have a fine skin which will readily anodise put their trust in Great Bridge Foundries

PRECISION CASTINGS IN ALUMINIUM, GUN METAL, GREY IRON, ETC. TO ALL SPECIFICATIONS

Phos. bronze and gun metal solid and cored sticks always in stock



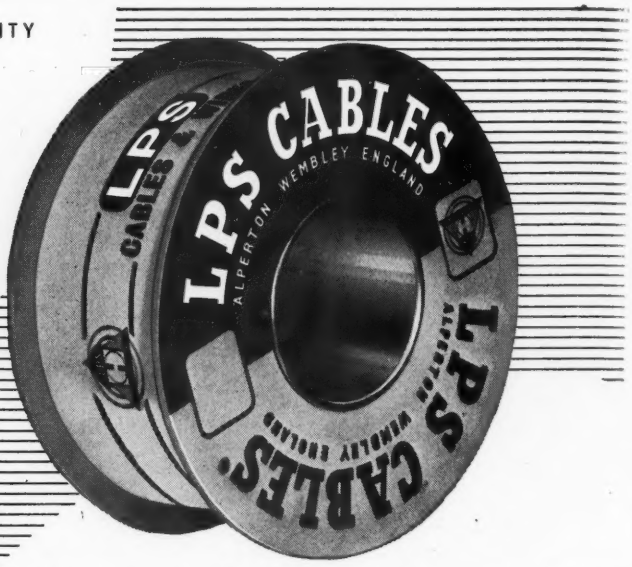
THE GREAT BRIDGE FOUNDRY CO. LTD.
Sheepwash Lane Great Bridge - Tipton
Staffordshire Telephone TIPton 1540
MEMBERS OF THE GBF GROUP

THE SIGN OF A GBF GOOD CASTING

THE SYMBOL OF QUALITY

LPS

INSULATED
WIRES & CABLES



Quality Cables

Manufactured and tested in strict accordance with—

B.S.S. 1557 — Polythene Insulated and P.V.C. sheathed cables
B.S.S. 2004 — P.V.C. insulated and sheathed cables
B.S.S. 7 — Rubber Cables and flexibles

L.P.S. ELECTRICAL CO. LTD.

122 DRURY LANE, LONDON, W.C.2

Telephone: COVent Garden 3231 (8 lines) **'Grams: Engineyor, Phone, London** **Works: St. Leonards-on-Sea—Hastings 7061**

WEIR ELECTRICAL INSTRUMENT CO. LTD. • WEIR ELECTRICAL INSTRUMENT CO. LTD. • WEIR ELECTRICAL INSTRUMENT CO. LTD.

SWITCHBOARD INSTRUMENTS

Switchboard instruments from 4" to 8" dial sizes in Flush, Projecting, Round and Rectangular cases. Portable instruments, Single or Multi-range.

Moving Coil, Moving Iron and Rectifier types.

Milliammeters, Ammeters and Voltmeters for the measurement of Direct, Alternating and Audio Frequency Currents. Frequency Indicators.

Special Instruments made for customers' particular requirements.

Transductors for the measurement of Heavy Direct Currents up to 40,000 Amperes.

Leaflets giving further details will be sent on request.

THE
WEIR ELECTRICAL INSTRUMENT CO. LTD.
Bradford-on-Avon, Wiltshire
Telephone: Bradford-on-Avon 2378

London Area Office:
2 Hill Street, St. Albans, Herts
Telephone: St. Albans 51722

Manchester Office:
270-272 Corn Exchange Buildings, Manchester 4. Telephone: Blackfriars 7795

Weir

ELECTRICAL INDICATING INSTRUMENTS

WEIR ELECTRICAL INSTRUMENT CO. LTD. • WEIR ELECTRICAL INSTRUMENT CO. LTD. • WEIR ELECTRICAL INSTRUMENT CO. LTD.

Regional Guide to

ELECTRICAL CONTRACTORS

LONDON

J. G. SNEATH LTD.
Wallwood Street, Limehouse, E.14
Telephone: EASt 2428-9
Rewinds and Repairs. Industrial Installations

Motor and Generator Repairs and Rewinds, Lighting and Power Installations. Factory Maintenance Contracts
COLLINS ELECTRICAL LTD.
115 Clerkenwell Road, E.C.1
Telephone: HOLborn 0212-3-4 & CANonbury 3227-8

Lighting, Heating and Power Installations. Factory Maintenance and Motor Stockists
C. J. FERGUSON & SONS LTD.
33 Barbican, London, E.C.1
Telephone: MONarch 5474-5

Industrial Installations. Power, Heating and Lighting. Factory Maintenance. Electrical Engineers. Break-down Specialists
F. A. ORRICK & CO. LTD.
157 Camberwell Road, S.E.5
Telephone: RODney 5548

BARLOW & YOUNG LTD.
55 Catherine Place, Westminster, S.W.1
Telephone: VICtoria 7373
Installations of all Types

BERKELEY ELECTRICAL ENG. CO. LTD.
Vincent House, Vincent Square, S.W.1
Telephone: VICtoria 8051
Electrical Engineers and Contractors

BUCHANAN & CURWEN LTD.
66 Victoria Street, Westminster, S.W.1
Telephone: VICtoria 6550
Electrical Engineers and Contractors

H. J. CASH & CO. LTD.
Caxton House, Tothill Street, S.W.1
Telephone: WHItehall 4774
Electrical Engineers and Contractors

EDMUNDSONS CONSTRUCTION CO. LTD.
Electrical Engineers and Contractors
24-30 Gillingham Street, S.W.1
Telephone: VICtoria 1713

One of the Largest Electrical Contractors in the Industry
ELECTRICAL INSTALLATIONS LTD.
65 Vincent Square, Westminster, S.W.1
Telephone: VICtoria 2266 (10 lines)

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
39 Victoria Street, S.W.1
Telephone: ABBey 8080 (8 lines)

TROUGHTON & YOUNG LTD.
2 Basil Street, London, S.W.3
Telephone: Kensington 3444
Electrical Engineers and Contractors

BURDETTE & CO. LTD.
150 Clapham Manor Street, S.W.4
Telephone: MACaulay 4555
Industrial Installations. Motor and Generator Repairs. Metallizing Treatments. Complete Electrical Maintenance. Heating and Ventilating.

WILSON ELECTRIC (BATTERSEA) LTD.
122a, Clapham Manor Street, S.W.4
Telephone: MAC 6768 & 3737
Electrical Engineers and Contractors. Motor Rewinds and Repairs. Installations. "Delco" Electric Motors.—Approved Stockists and Repairers.

Electrical Engineers and Contractors
J. A. BROWN & PARTNERS LTD.
123 Warwick Road, S.W.5
Telephone: Fremantle 5546

Industrial Installations throughout the Country. Power, Maintenance and Insurance
CITY ELECTRICAL CO.
Emerald Street, W.C.1 *Telephone: HOL. 9722 (6 lines)*
Repairs and Rewinds—Motor Stockists

A. TINDALL & SONS
22 Rosemary Avenue, Enfield
Electrical Engineers and Contractors
Telephone: ENField 6612 (3 lines)

SERVICE ELECTRIC CO. LTD.
Secomak Works, Honeypot Lane, Stanmore, Middx.
Telephone: EDGware 5566-7-8-9
Electrical Installations of every kind. Motor Rewinds. Factory Maintenance

DYNAMO & MOTOR REPAIRS LTD.
North End Road, Wembley Park
Telephone: Wembley 3121
Motor and generator repairs and rewinds. Installations and factory maintenance. Electrical plant stockists

SOUTH EASTERN

GALLIERS
32 St. James's Street, Brighton
Telephone: Brighton 23201-2-3
Farm and Dairy Electrical Equipment

Electrical, Refrigeration and Radio Engineers. Installation Contractors. Lifts. Television
H. BENEY & SONS LTD.
99 South Street, Eastbourne
Telephones 4820/1 (Day and Night)

For first-class A.C. and D.C. Rewinds and Industrial Plant Maintenance
ELECTRICAL POWER REPAIRS (Gillingham) LTD.
Strover Street, Gillingham, Kent
Telephone: Gill. 5200 & 59356 (Day and Night)

BUCHANAN & CURWEN LTD.
Electrical Engineers and Contractors
Fairfield Works, Leatherhead, Surrey
Telephone 3481 (3 lines)
Branches in Dorking and East Horsley

Heavy Engineering and Electrical Contracting
DRAKE & FLETCHER LTD.
Maidstone, Kent
Telephone 2284
Refrigeration, Oil Heating and Drying Installations

F. W. BLANSHARD LTD.
23 Lansdowne Road, Purley, Surrey
Telephone: Uplands 4818, 4819 & 4810
Complete electrical installations. Rewinding and repair of motors and transformers. Manufacturers of control gear for fluorescent.

SOUTHERN

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
32 Brassey Road, Winton, Bournemouth
Telephone: Winton 1609

. . . for all electrical installations
F. H. WHEELER (Southern) LTD.
Clifton Hall, Oakley Road, Shirley, Southampton
Telephone 73867

SOUTH WESTERN

BUCHANAN & CURWEN LTD.
15 Orchard Street, Bristol 1
Telephone 22723
Electrical Engineers and Contractors

. . . for all electrical installations
F. H. WHEELER (Bristol) LTD.
55 Queen Charlotte Street, Bristol 1
Telephone 26907

CLARKE BROS. (Stroud) LTD.
Bath Road, Stroud
Telephone: Stroud 1132/3
Electrical Engineers and Contractors
Rewinds and Repairs. Industrial Installations

EASTERN

Norwich....Cambridge....Gt. Yarmouth....Lowestoft....Ipswich
EASTERN & HOME COUNTIES ELECTRICAL CONTRACTORS
Specialists in Large Scale Electrical Installation Contracts.
Westwood House, Southtown Road, Gt. Yarmouth
Telephone: Gt. Yarm. 2390

(Continued on page 104)

(Continued from page 103)

TUCKER BROS. ELECTRICAL ENGINEERS (ESSEX) LTD.
32 Station Lane, Hornchurch, Essex
Telephone: Hornchurch 842
Installation and Maintenance Engineers

V. J. SKERRY (Partners: V. J. & M. W. Skerry)
72 High Street, Huntingdon, Hunts
Telephone: Huntingdon 524
Electrical Engineers and Contractors. (Certificate. Approved Contractors)

EAST MIDLANDS

PENNEY & PORTER LIMITED
Riverside Works, Lincoln
Telephone : Lincoln 11337
Industrial & Domestic Electrical Installations. Motor & Generator Repairs & Rewinds. Lift & Plant Maintenance. Neon & Illuminated Signs

MIDLANDS

Electrical Industrial Installations. Power, Heating and Lighting. Factory Maintenance. E.C.A. Electrical Engineers
PARKER, WINDER & ACHURCH LTD.
259 Broad Street, Birmingham 1
Telephone: MIDland 5001

WALKER BROS. (ELECTRICAL ENGINEERS) LTD.
Quality House, Temple Row, Birmingham 2
Telephone: CEN. 7611/5
Electrical Installation Engineers. Industrial Installation Specialists
Established 1895

Electrical Installation Engineers
J. A. BROWN & PARTNERS LTD.
Head Office: 124 Livery Street, Birmingham 3
Telephone: Central 3412
Branches in London and Manchester

HARRIS & SHELDON LTD.
31 Stafford Street, Birmingham 4
Telephone: Central 7101
For all electrical contracting installations, lighting, heating, power, public address, etc.

Electrical and Mechanical Engineers, Factors
THE BIRMINGHAM POWER TRANSMISSIONS LTD.
56-62 Miller Street, Aston, Birmingham 6
Telephone: AST. 2088-9

For Electrical Installations of Quality consult:
HAROLD F. WARD LIMITED
420 Stratford Road, Birmingham 11
Telephone: VIC. 4041 (5 lines)

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
553 Moseley Road, Birmingham 12
Telephone: Calthorpe 2601-2

DYNAMO & MOTOR REPAIRS LTD.
Belgrave Terrace, Soho Road, Birmingham 21
Telephone: Northern 0898
Motor and generator repairs and rewinds. Installations and factory maintenance. Electrical plant stockists

ELECTRICAL INSTALLATIONS LTD.
Faraday Works, Stoney Stanton Road, Coventry
Telephone 2970
Industrial Electrical Work of All Kinds. Over 40 Years' Experience

G. G. WALKER & CO. (Dudley) LTD.
31 Hall Street, Dudley
Telephone : 4474/5
Rewinds, Lighting, Power, Electric Furnace, Electronic Installations and Maintenance. Est. 40 years. E.C.A. Members.

COOPER & CO. (SHREWSBURY) LTD.
29/31 Ellesmere Road, Shrewsbury
Telephone 4618 (2 lines)
For all classes of Electrical Installations
Members of E.C.A. Contractors to H.M. Govt. Depts.

SOUTH WALES

CLARKE BROS. (Stroud) LTD.
Green Park Street, Aberavon
Telephone : Port Talbot 791
Electrical Engineers and Contractors
Rewinds and Repairs. Industrial Installations

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
117 Woodville Road, Cardiff
Telephone 21281-2 *Telegrams: "Whelect"*

CLARKE BROS. (Stroud) LTD.
High Street, Merthyr Tydfil
Telephone : Merthyr Tydfil 377
Electrical Engineers and Contractors
Rewinds and Repairs. Industrial Installations

MERSEYSIDE & N. WALES

TROUGHTON & YOUNG LTD.
46 Rodney Street, Liverpool 1
Telephone: Royal 9231-2
Electrical Engineers and Contractors

H. J. CASH & CO. LTD.
28 Chapel Street, Liverpool 3
Telephone : Central 0452
Electrical Engineers and Contractors

YORKSHIRE

Electrical Engineers and Contractors
SOUTHERN & REDFERN LTD.
Woodhead Road, Bradford 7
Textile Maintenance, Repairs and Rewinds
Telephones: Bradford 23871—Late Phone: Bradford 65837

EDMUNDSONS CONSTRUCTION CO. LTD.
Electrical Engineers and Contractors
2 Hartley Hill, Leeds 2
Telephone: Leeds 33791

. . for all electrical installations
F. H. WHEELER & CO. LTD.
44 Bank Street, Sheffield 1
Telephone 24015 (3 lines) *Telegrams: "Whelect"*

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
Paver Lane, York
Telephone: York 23172

NORTH WESTERN

STEWART THOMSON & SONS (Liverpool) LTD.
Fort Road, Seaforth, Liverpool 21
Repairs and Rewinds A.C. and D.C. to 3,000 horsepower. Breakdowns, Urgent Repairs, etc. 24-hour service
Telephone: Bootle 2697-8

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
Regal Buildings, Oxford Road, Manchester 1
Telephone: Central 8207-8

Industrial Installations
W. H. SMITH & CO. ELECTRICAL ENGINEERS LTD.
12 York Street, Manchester 2
Telephone: CENtral 2991-6
Works: Praed Road, Trafford Park, Manchester 17

Electrical Engineers and Contractors
J. A. BROWN & PARTNERS LTD.
366 Stretford Road, Manchester 15
Telephone: Moss Side 3157

THE NELSON ENGINEERING CO. LTD.
Telephone: Nelson 1545/6
Electrical and Mechanical Engineers.
Complete Industrial Installations. Rewinds
Netherfield Road, Nelson

H. J. CASH & CO. LTD.
126 Trafford Road, Salford 5
Telephone : Trafford Park 1489
Electrical Engineers and Contractors

NORTH EASTERN

DALE ELECTRIC (YORKSHIRE) LTD.
Filey, Yorks. Also at Malton and Driffield
Telephone: Filey 2301 (3 lines)
Manufacturers of the DALE diesel and petrol electric generating plants. All types of electrical contracting. Estimates free and without obligation.

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
52 Elswick Road, Newcastle
Telephone: Newcastle 36271

SOUTH WEST SCOTLAND

. . . for all electrical installations
F. H. WHEELER (Scotland) LTD.
144-6 North Street, Glasgow
Telephone: Central 2921

Applications for particulars of costs and standard style of advertisements in this Regional Guide should be addressed to:

THE
ADVERTISEMENT DEPARTMENT,
ELECTRICAL REVIEW,
DORSET HOUSE, STAMFORD STREET,
LONDON, S.E.1

points to increased production

Increased production with lower labour costs can be achieved by changing over from the conventional Machine Screw to the self tapping, self locating type known among *production minded* production men simply as—the TAPPING SCREW.

By forming its own thread as it is driven home the Tapping Screw does away with a nut, or eliminates a separate and expensive tapping operation. The self locating point is a tremendous help to operators in assembly, and more important still, lines up those difficult out-of-line holes.

The Tapping Screw will always make a stronger, faster, easier, cheaper and better looking job. And, if you want the best of both worlds, you can have all these advantages *plus* the Phillips Recessed Head.

Linread

LINREAD LTD • COX ST • BIRMINGHAM 3

SLOTTED AND PHILLIPS RECESSED HEAD MACHINE SCREWS AND TAPPING SCREWS • HIGH TENSILE HEXAGON HEAD BOLTS AND SETSCREWS AIRCRAFT BOLTS, SCREWS AND RIVETS • SEMS • RIVNUTS • CUSTOM DESIGNED COLD FORGED FASTENERS • ALEX SCREWPLUGS.

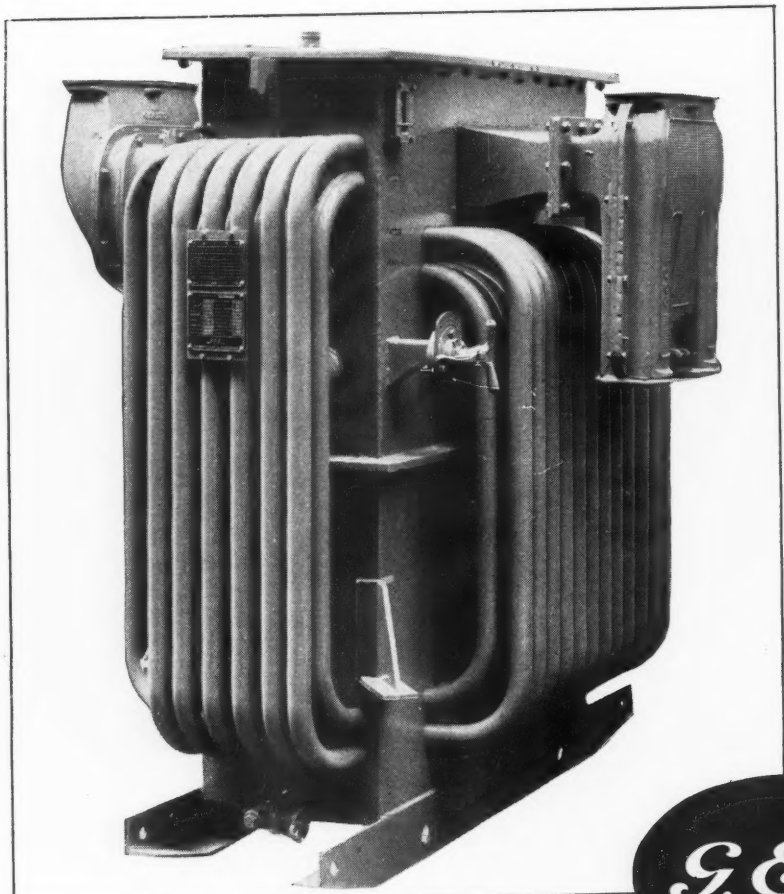
Beardmore

I

Built to Central Electricity Authority Specification T.1

or to customers' own requirements.

5 to 1000 kVA



G.E.C.

transformers

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number there is an additional charge of 1/-.

DISPLAYED CLASSIFIED:—48/- per inch. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

ADVERTISEMENTS are accepted up to First Post on Monday of the week of issue and should be addresssed to ELECTRICAL REVIEW, Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

COUNTY COUNCIL OF THE COUNTY OF LANARK

Trunk Roads Lighting, A.73, A.74 and A.80

THE County Council invite tenders for the supply of 151 Street Lighting Lanterns complete with transformers and capacitors for 140-watt sodium discharge lamps. Electric light fittings manufacturers desirous of tendering should make application for the tender documents to the County Lighting Engineer, 29, Clydesdale Road, Hamilton.

Tenders in a plain sealed envelope endorsed "Trunk Road Lighting" must be delivered to the County Lighting Engineer, at the above address, not later than 10 a.m. on Wednesday, 31st July, 1957.

The Council do not bind themselves to accept the lowest or any tender.

IAN V. PATERSON,
County Clerk.

Lanarkshire House,
Glasgow.
2nd July, 1957. 6596

COUNTY COUNCIL OF THE COUNTY OF LANARK

Trunk Roads Lighting, A.73, A.74 and A.80

THE County Council invite tenders for the supply of 134 Steel Street Lighting Columns. Manufacturers of steel columns desirous of tendering should make application for the tender documents to the County Lighting Engineer, 29, Clydesdale Street, Hamilton.

Tenders in a plain sealed envelope endorsed "Trunk Road Standards" must be delivered to the County Lighting Engineer, at the above address, not later than 10 a.m. on Wednesday, 31st July, 1957.

The Council do not bind themselves to accept the lowest or any tender.

IAN V. PATERSON,
County Clerk.

Lanarkshire House,
Glasgow.
2nd July, 1957. 6595

BOROUGH OF MORLEY

Street Lighting, Trunk Road A.650

TENDERS are invited for the supply, erection and installation of 25 140-watt Sodium Lighting Units on the Trunk Road A.650.

Specifications and forms of tender, upon payment of a deposit of £2 2s., which will be refunded after the receipt of a bona fide tender, can be obtained from the Public Lighting Engineer, Town Hall, Morley, to whom completed tenders should be returned not later than 29th July, 1957.

E. V. FINNIGAN,
Town Clerk.

Town Hall,
Morley, Yorks. 6607

BOROUGH OF MORLEY

Street Lighting, Trunk Road A.650

TENDERS are invited for the supply of 34 140-watt Sodium Lanterns.

Specifications and forms of tender, upon payment of a deposit of £2 2s., which will be refunded after the receipt of a bona fide tender, can be obtained from the Public Lighting Engineer, Town Hall, Morley, to whom completed tenders should be returned not later than 29th July, 1957.

E. V. FINNIGAN,
Town Clerk.

Town Hall,
Morley, Yorks. 6608

BOROUGH OF WILLESDEN

Street Lighting: Harrow Road, Craven Park (part), Craven Park Road, Harlesden High Street, Station Road

TENDERS are invited from experienced contractors for the following Group "A" lighting work to be carried out as separate contracts over a length of approximately three miles of Class I highway:—

(a) Supply of sodium lanterns and ancillary equipment.
(b) Supply and erection of concrete columns, wiring and fixing of lanterns and ancillary equipment.

The contract documents may be obtained from the Borough Engineer and Surveyor, Town Hall, Dyne Road, Kilburn, London, N.W.6, upon application accompanied by a deposit of two guineas, which will be returned upon receipt of a bona fide tender not subsequently withdrawn.

Sealed tenders must be submitted so as to reach the undersigned by not later than 10 a.m. on the 22nd July, 1957.

R. S. FORSTER,
Town Clerk.

Town Hall,
Dyne Road,
Kilburn, London, N.W.6. 6498

THE DAMODAR VALLEY CORPORATION

THE office of Damodar Valley Corporation, Anderson House, Alipore, Calcutta, 27, India, invites tenders for the following:—

132-kV and 33-kV Pedestal-type Insulators for Grid Substations.

Tender specifications PE-Spec-15, which are for sale at £3 15s. per copy plus £1 17s. 6d. for air parcel charges, are obtainable direct from the Controller of Purchase and Stores, Damodar Valley Corporation, Anderson House, Alipore, Calcutta, 27, India.

Tenders are to be returned direct to the above address for opening on the 20th August, 1957.

Specimen copy of above specifications is on view at India Store Department, Government Building, Bromyard Avenue, Acton, London, W.3. Reference S.1555/57/AVH/CIV.2. 6606

SITUATIONS VACANT

CENTRAL ELECTRICITY AUTHORITY

North Eastern Division

Appointment of Fourth Assistant Engineer (Mech.), Generation (Construction) Dept.

APPLICATIONS are invited for the appointment of FOURTH ASSISTANT ENGINEER (Mech.) in the Generation (Construction) Department with Headquarters at Carliol House, Newcastle upon Tyne.

Applicants should possess a Higher National Certificate or equivalent qualification and have had some experience in the mechanical aspects of power station construction, drawing office experience is also desirable.

The salary for the appointment (which is superannuable) will be in accordance with Grade 6, Schedule B of the National Joint Board Agreement (£710-£910 per annum) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from Divisional Establishments Officer, Central Electricity Authority, North Eastern Division, Carliol House, Newcastle upon Tyne, 1, to arrive not later than 31st July, 1957. 6660

CITY OF BELFAST

APPLICATIONS are invited for the following positions in the Generation Section of the Electricity Department:—

(1) JUNIOR ASSISTANT SHIFT ENGINEER.

Applicants, not more than 35 years of age, must have a University Degree or the Higher National Certificate in Electrical or Mechanical Engineering, or be Corporate Members of the Institution of Electrical Engineers. They must have had a sound engineering training.

Weekly wages equivalent to Grade II, Class H, of the N.I.J.B. Schedule, viz., £790 × £15 to £835 per annum plus 7½% shift allowance. Upon completion of twelve months' satisfactory service the position will be established on the salary list.

2. SENIOR ENGINEERING TRAINEE.

Applicants, not more than 25 years of age, must either (a) have had sound practical training in the electrical industry and hold Ordinary National Certificate in Electrical Engineering, or (b) possess a Higher National Certificate, or equivalent, or a degree in Electrical Engineering.

Weekly wages to those qualified under (a) £8 per week during first year of training, rising to £8 10s. per week in second year; and (b) £9 per week during first year of training, rising to £9 10s. per week in second year.

(3) TRAINEE CHEMIST.

Applicants, not more than 25 years of age, must be University Graduates in Chemistry or Chemical Engineering.

Weekly wages £9 per week during first year of training, rising to £9 10s. per week in second year.

A Senior Engineering Trainee possessing technical qualifications equivalent to the Higher National Certificate, or a Trainee Chemist, after completing satisfactorily two years' training, will be offered a position as Junior Engineering Assistant or Junior Engineering Assistant (Chemical) respectively, paid on a weekly basis in accordance with Grade 14, at present Class H, of the N.I.J.B. Schedule, viz., £635 × £15 to £680 per annum pending appointment to an established post.

The following conditions apply to all the above posts:—

Superannuation contributions of approximately 6% of remuneration will be payable. Reciprocal pension arrangements exist between the Corporation and other public authorities.

Canvassing will disqualify.

Application forms are obtainable from the Electricity Department, East Bridge Street, Belfast. Completed applications must reach the undersigned by Friday, 26th July, 1957.

JOHN DUNLOP,
Town Clerk.

City Hall, Belfast.
P.O. Box 234.
4th July, 1957. 6652

ELECTRICAL SALES ENGINEER

for senior appointment with company of repute whose development programme is founded on, but not restricted to, special-purpose rotating machines and control gear which have already proved themselves in service.

Position of exceptional interest for technically qualified man who, resident in London area, has that combination of personality, ability and integrity which readily commends him and his company to a potential client.

If you would appreciate lively response to new projects and can bring them in, we want you. Write and tell us your true worth and the substance of it.—Box 6581.

Situations Vacant (continued)

CENTRAL ELECTRICITY AUTHORITY

East Midlands Division

APPLICATIONS are invited for the following appointments :—

ASSISTANT SHIFT CHARGE ENGINEER, SPONDON POWER STATION
(Vacancy No. 107/57/ER).

Applicants should have had a sound training and experience in a modern generating station. Preference will be given to candidates who possess the Higher National Certificate or its equivalent.

Salary will be in accordance with Class H, Grade 9 (£885-£930 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 24th July, 1957.

SENIOR ASSISTANT ENGINEER (Resident), CASTLE DONINGTON POWER STATION (Vacancy No. 108/57/ER).

The duties for the above position include general supervision of the erection and commissioning of all mechanical and electrical plant; for example, turbo-alternators and condensing plant, feed heating equipment, boilers, pumps, high-pressure steam and feed piping, switchgear, transformers and cables, coal and ash handling plant and ancillary equipment. Corporate Membership of the Institution of Mechanical Engineers or the Institution of Electrical Engineers would be a recommendation.

Candidates should be experienced in the supervision of such power station equipment and in co-ordinating work on site in close collaboration with the Resident Engineer responsible for civil engineering and building works and with Divisional Headquarters staff.

Salary will be in accordance with Class AX/EX, Grade 1 (£1,330-£1,595 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 24th July, 1957.

FIRST ASSISTANT STATION CHEMIST, NORTH WILFORD POWER STATION
(Vacancy No. 109/57/ER).

Candidates must have had previous experience in a power station laboratory and should preferably be qualified for admission to the Associateship of the Royal Institute of Chemistry; consideration will however be given to suitably experienced holders of the Higher National Certificate in Chemistry.

Applicants must be familiar with the routine methods, sampling and analysis (including physical testing) of coal, oil, water and other materials and with the interpretation and application of the analytical results.

Salary will be in accordance with Class K, Grade 9 (£995 - £1,055 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 24th July, 1957.

SENIOR DRAUGHTSMAN (Electrical), GENERATION (Construction) DEPT.
(Vacancy No. 113/57/ER).

Candidates should have experience of the preparation of layouts and diagrams for the installation of E.H.T. and L.T. switchgear, transformers, E.H.T. and L.T. cables; knowledge of protective gear systems would be an advantage.

SENIOR DRAUGHTSMAN (Civil), GENERATION (Construction) DEPT.
(Vacancy No. 112/57/ER).

Candidates should have experience of the preparation of detail drawings and in the design of one or more of the following subjects :—

Reinforced concrete structures.
Pile and slab foundations for heavy components.
Cable subways, bridges and culverts.

SENIOR DRAUGHTSMAN (Mechanical), GENERATION (Construction) DEPT.
(Vacancy No. 114/57/ER).

Candidates should have expeirence of one or more of the following :—

(i) Design and layout of power station equipment, including turbo-alternators, boiler plant, coal and ash plant and general station auxiliaries.
(ii) H.P. and L.P. steam and feed pipework. Condensing plant and feed heating systems.
(iii) Conveyor plant, coal handling systems and material handling of station auxiliary equipment.

Salary for vacancies 112/57, 113/57 and 114/57 will be within Grade 4 (£895-£995 per annum) or Grade 5 (£760-£860 per annum) of Schedule D of the National Joint Board Agreement.

Closing date for receipt of applications, 31st July, 1957.

THIRD ASSISTANT ENGINEER (Electrical), GENERATION (Construction) DEPT., NORTH WILFORD POWER STATION (Site Office)
(Vacancy No. 111/57/ER).

Applicants should have had a fundamental training in electrical engineering, including workshops, and should preferably have had experience in the manufacture, erection and maintenance and operation of electrical plant as installed in modern power stations. Preference will be given to candidates who possess a Degree or are Graduate Members of the Institution of Electrical Engineers.

Salary will be within Class AX/EX, Grade 4 (£895-£1,140 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 31st July, 1957.

THIRD ASSISTANT ENGINEER (Electrical), GENERATION (Construction) DEPT., LINCOLN POWER STATION SITE
(Vacancy No. 116/57/ER).

Applicants should have had a fundamental training in electrical engineering, including workshops, and should preferably have had experience in the manufacture, erection and maintenance and operation of electrical plant as installed in modern power stations. Preference will be given to candidates who possess a Degree or are Graduate Members of the Institution of Electrical Engineers.

Salary will be within Class AX/EX, Grade 4 (£895-£1,140 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 31st July, 1957.

GENERAL ASSISTANT ENGINEERS, STAYTHORPE, WILLINGTON, SPONDON and DERBY POWER STATIONS
(Vacancy No. 119/57/ER).

Applications are invited for the positions of General Assistant Engineer at the above stations where suitable young men will be given opportunities to obtain experience in all sections of a power station.

Preference will be given to candidates who hold the Higher National Certificate or who are at present pursuing a course of study with the object of obtaining this or a similar qualification.

The salary will be in accordance with the National Joint Board Agreement within the range £540-£730 per annum, according to knowledge and experience.

Closing date for receipt of applications, 31st July, 1957.

These appointments will be pensionable within the provisions of the Central Electricity Authority and Area Boards (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Authority, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote vacancy number.

L. F. JEFFREY,
Divisional Controller.

4th July, 1957. 6629

SALES MANAGER

APPLICATIONS are invited for the above position which will shortly become vacant in a well-known electrical accessory manufacturing company. Applicants must possess good personality, a high degree of initiative and considerable drive, and be able to develop and expand sales through existing representatives and agents.

A high salary is offered to suitable applicant, and a contributory pension scheme is in operation.

Applications will be received in strict confidence, and should include full details of the candidate's career, together with salaries received.—Box 6529.

WESTERN REGIONAL HOSPITAL BOARD, SCOTLAND

APPLICATIONS are invited for the following appointments:—

DEPUTY REGIONAL ENGINEER.

Applicants should be engineers of professional standing and should be Corporate Members of the Institution of Mechanical Engineers, Institution of Electrical Engineers or Institution of Civil Engineers with wide experience of all branches of hospital engineering, design and operation. The person appointed will be required to act for the Regional Engineer over the whole range of the services for which the engineer is responsible and be able to advise the Board in the absence of the Regional Engineer. He will also be responsible for the day-to-day supervision of the engineering departments of the board's works organisation.

Salary scale £1,345 × £55 (2) × £50 (2) × £35 (1) to £1,590.

ASSISTANT ENGINEERS.

Applications are invited for two posts of Assistant Engineer for electrical and heating duties respectively. Applicants should be Corporate Members of, or have obtained the technical standard of Corporate Members of, the Institutions of Electrical Engineers or Heating and Ventilating Engineers respectively and should have practical and theoretical experience of design, installation and operation and general maintenance and should be capable of assisting in preparing specifications and estimates and advising generally on the classes of plant in their own particular field, viz.,

(a) Electrical.
Electrical installation, including heating, lighting and power, and
(b) Heating.
Heating, ventilating, hot water, air conditioning, refrigerating, sterilising and pipe work installations in large buildings, laundries, kitchens, etc.

Salary scale £680 × £25 (3) × £30 (2) × £35 (1) × £30 (1) × £35 (3) to £985.

CLERK OF WORKS
(Electrical and Mechanical).

Applicants should have served an apprenticeship in mechanical or electrical engineering and have had not less than five years' experience supervising site installations, employing trades associated with mechanical heating and ventilating and/or electrical engineering.

Salary scale £615 × £22 (2) × £25 (3) to £730.

The successful applicants will be required to pass a medical examination and all appointments are subject to a deduction at the rate of 6% per annum for superannuation. In the case of the Deputy Regional Engineer the appointment will be subject to three months' notice of termination on either side and in the other appointments two months' notice on either side is required.

Applications, giving particulars of qualifications and experience, together with the names of three referees, should be lodged with the Secretary, Western Regional Hospital Board, 64, West Regent Street, Glasgow, C.2, not later than 20th July, 1957. 333

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointment in the Northmet Sub-Area. The successful candidate will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

SUB-AREA HEADQUARTERS, LONDON, N.14.
SUB-AREA ENGINEER (77/57.R).

Candidates should be Corporate Members of the Institution of Electrical Engineers and must have had extensive experience in the planning, operation, maintenance and construction of large distribution systems covering both urban and rural areas.

Salary will be in accordance with Scale 5 of the National Joint Managerial and Higher Executive Grades Agreement (£1,975 × £50 to £2,125) plus London allowance.

Apply by letter to C. C. Hill, B.Sc.(Eng.), M.I.E.E., M.I.Mech.E., Manager, Northmet Sub-Area, Eastern Electricity Board, Northmet House, Southgate, London, N.14, so as to be received not later than Wednesday, 17th July, 1957.

Applications received in response to the previous advertisement (47/57.R) will be considered and those applicants need not re-apply. 6676

YORKSHIRE ELECTRICITY BOARD

No. 6 (Hull) Sub-Area
HULL DISTRICT

LOCAL MANAGER AND ENGINEER (Hornsea and Withernsea).

Applications are invited from fully qualified engineers possessing a wide experience of operation and maintenance of extensive rural and urban E.H.V. and L.V. networks.

Applicants should be capable of conducting correspondence and of controlling a small administrative and commercial staff, together with their activities.

Salary N.J.B. Class J, Grade 7, £1,065/£25/£1,140 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, not later than 26th July, 1957.

No. 2 (Huddersfield) Sub-Area
HUDDERSFIELD DISTRICT

THIRD ASSISTANT DISTRICT ENGINEER. Applicants should be Graduate Members of the Institution of Electrical Engineers or hold equivalent qualifications and have had experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant and ancillary equipment.

Salary N.J.B. Class H, Grade 9, £885/£15/£930 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 2 (Huddersfield) Sub-Area, Yorkshire Electricity Board, Market Street, Huddersfield, not later than 26th July, 1957.

No. 4 (Leeds) Sub-Area

ENGINEERING DRAUGHTSMAN (Electrical). Applicants should have had a good general and technical education to a minimum standard of O.N.C. and be neat and capable draughtsmen.

Experience in the layout of plant in substations and in the preparation of electrical diagrams will be an advantage.

Salary N.J.B. Schedule D, Grade 6, £595/£20/£715 per annum.

LEEDS DISTRICT

ASSISTANT CONSUMERS' ENGINEER. Applicants must have had a sound practical and theoretical training and should preferably hold an appropriate qualification. They will be required to negotiate with consumers in respect of new and additional supplies and associated load development, tariffs and installation testing.

A sound knowledge of all electricity regulations is essential.

Salary N.J.B. Class K, Grade 12, £835/£15/£880 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 4 (Leeds) Sub-Area, Yorkshire Electricity Board, Bramhope, Leeds, not later than 26th July, 1957.

No. 3 (Sheffield) Sub-Area
MEXBOROUGH DISTRICT

THIRD ASSISTANT DISTRICT ENGINEER. Applicants should preferably have technical qualifications equivalent to Corporate Membership of the Institution of Electrical Engineers and have had general experience in electrical distribution work.

Salary N.J.B. Class F, Grade 9, £790/£15/£835 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial Street, Sheffield, not later than 26th July, 1957.

No. 5 (Wakefield) Sub-Area
BARNSLEY DISTRICT

ASSISTANT CONSUMERS' ENGINEER. Applicants should preferably have had experience in negotiations for new supplies and advice on supplies and tariff matters, including proposed wiring installations and industrial and agricultural equipment, disputed accounts involving technical or metering problems, and investigation of voltage complaints and assisting with street lighting negotiations.

Salary N.J.B. Class G, Grade 13, £635/£15/£680 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a, Denby Dale Road, Wakefield, not later than 26th July, 1957. 6651

THE NELSON RESEARCH LABORATORIES

of the

ENGLISH ELECTRIC COMPANY LIMITED, STAFFORD,

have vacancies for

1. ENGINEERS

to design power control and distribution equipment. Duties involve preparation of specifications for equipment, including wiring diagrams and purchase of components. Candidates should either have obtained the Higher National Certificate in Electrical Engineering or be taking a course of studies leading up to this level.

2. INSTALLATIONS ENGINEERS

for Electrical and Electronic equipment. The selected candidate will be required to work in close co-ordination with the Engineering Sections and Laboratories in planning installations, both within the department and on outside contract work. Complete specifications for installation and methods of testing are required. Candidates should preferably have some knowledge of the Factories Act and Institution Wiring Regulations. Acceptable qualifications will be of the standard of Higher National Certificate or, alternatively, the candidate should be taking a course of studies leading up to this level.

Please write—

Dept. C.P.S.,
336/7, Strand, London, W.C.2,

quoting
Ref. ER.918A.

6614

CENTRAL ELECTRICITY AUTHORITY

Midlands Division

FOURTH ASSISTANT ENGINEER is required in the System Operation Department at Divisional Headquarters, Birmingham. N.J.B. service conditions, superannuable appointment, salary within Schedule B, Grade 6, commencing in range £710-£835, ultimately rising to £935 per annum.

The duties are of a general technical and statistical nature and applicants should have had a sound technical training and practical experience preferably in connection with system control. The possession of Higher National Certificate in Electrical Engineering or equivalent qualifications will be considered an advantage.

Apply, quoting vacancy number 588MD on form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 23rd July, 1957. 6659

CENTRAL ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

STATION SHIFT CHARGE ENGINEER, BECKENHAM POWER STATION (Vacancy No. 57/614).

Practical experience necessary in efficient operation of power station plant.

Salary Class B, Grade 7 = £725 p.a. plus £68 10s. p.a. shift allowance.

ASSISTANT ENGINEER (Shift), BARKING A/B POWER STATIONS (Vacancy No. 57/615).

Experience in the operation of E.H.T. switchgear, station auxiliaries and the control of large turbo-alternators would be an advantage. The duties of the successful applicant will be those of Second Assistant to the Station Shift Control Engineer.

Salary Class L, Grade 14 = £830 p.a. plus £79 p.a. shift allowance.

SHIFT CHARGE ENGINEER, BANKSIDE POWER STATION (Vacancy No. 57/616).

Practical experience in operation of power station essential with experience of high-pressure plant an advantage. Character and ability to deal with staff problems essential.

Salary Class H, Grade 7 = £1,045 p.a. plus £99 10s. p.a. shift allowance.

ASSISTANT SHIFT CHARGE ENGINEER, BLACKWALL POINT POWER STATION (Vacancy No. 57/617).

Sound technical training necessary with practical experience in operation of modern power station, preferably with pulverised fuel firing.

Salary Class F, Grade 9 = £830 p.a. plus £79 p.a. shift allowance.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, Central Electricity Authority, London Division, P.O. Box 136, Generation House, Great Portland Street, London, W.1, and be received within 10 days of this advertisement. 6609

MECHANICAL AND ELECTRICAL ENGINEERS IN VARIOUS GOVERNMENT DEPARTMENTS

THE CIVIL SERVICE COMMISSIONERS invite applications for pensionable posts in a wide variety of mechanical and electrical engineering duties.

Candidates must be under 35 on 1st January, 1957, with extension for regular service in H.M. Forces and appropriate civil service. For the Post Office they must be at least 21, for the Ministry of Supply and Ministry of Transport and Civil Aviation (Civil Aviation Organisation) at least 23; for other posts at least 25 on that date.

The achievement of corporate membership of one of the professional institutions (Mechanical Engineers, Electrical Engineers or Civil Engineers) is essential for most of the posts, but for some posts Associate Fellowship of the Royal Aeronautical Society or (in the Post Office) an Honours Degree in Engineering or Physics will be accepted. Candidates will however be admitted, provisionally, who have passed, or have exemption from, the appropriate sections of the examinations for the stipulated associate membership. Exceptionally a candidate with evidence of high professional attainment may be admitted. Relevant training and practical experience is expected.

London salary (men) £765 (at age 25) to £1,190. Starting salary according to age up to £1,030 at 34. Candidates entering below age 25 will start at salaries varying from £565 at age 21 to £685 at age 24. Prospects of promotion to higher grades on salary scales £1,215-£1,640 and £1,690-£1,950. Somewhat lower in the Provinces. Women's scales lower but being improved to reach equality with the men's scales by 1961.

Further particulars and application forms from Civil Service Commission, Scientific Branch, 30, Old Burlington Street, London, W.1, quoting No. S.85/57. Application forms should be returned by 30th September, 1957. Earlier applicants may be interviewed before that date. 6624

***Situations Vacant** (continued)*

SOUTH EASTERN ELECTRICITY BOARD

CABLE JOINTER (Extra High Tension), Sevenoaks and Reigate District, Reigate Horley Area. Wages 4s. 7½d. per hour for a 44-hour, 5-day week under N.J.I.C. conditions of employment.

Applicants must be experienced in working on live low and medium voltage cable and have experience in jointing cables and substation work up to and including 11 kV.

Applications, naming two referees, on forms from H. F. Gill, District Manager, SEEBOARD, Electric House, West Hill, Oxted, by 22nd July, 1957.

ASSISTANT (Expenditure), Twickenham and Richmond District. Salary £735 × £25 to £810 per annum plus London weighting under N.J.C. Grade 4. Superannuable.

Applicants should have a wide knowledge and experience of the work of a district office and be able to organise and control, under the district chief clerk, an expenditure section dealing with wages, costing, invoices, stores, etc.

Applications, naming two referees, on forms from J. D. Parkinson, A.M.I.E.E., A.I.Mech.E., Twickenham and Richmond Manager, SEEBOARD, 42, York Street, Twickenham, Middlesex, by 22nd July, 1957.

FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER, Twickenham and Richmond District. Salary £935 × £20 to £995 per annum plus London weighting under N.J.B. Class F, Grade 6. Superannuable.

Applicants must be suitably qualified electrical engineers with experience in sales and all aspects of service to all types of consumers (including industrial). Experience in D.C./A.C. changeover is also desirable.

Applications, naming two referees, on forms from J. D. Parkinson, A.M.I.E.E., A.I.Mech.E., Twickenham and Richmond Manager, SEEBOARD, 42, York Street, Twickenham, Middlesex, by 22nd July, 1957.

A. L. BURNELL.
6649

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:—

Central Gloucestershire Sub-Area

THIRD ASSISTANT ENGINEERS (Control) (five).

Applicants will be required to take charge of control operations of 11 kV, 33 kV, and 66 kV systems on shift rota. Technical qualifications desirable. Salary £885/£930 per annum. (N.J.B. Grade J.10).

SECOND ASSISTANT DISTRICT ENGINEER (Severn Vale District).

Duties involve the construction, maintenance and operation of E.H.V. and L.V. mains and substations and planning system reinforcements and mains extensions. Technical qualifications desirable. Salary £835/£880 per annum. (N.J.B. Grade E.7).

Apply by letter, within fourteen days, stating age, experience, present position and salary, to Mr. S. Raybould, Sub-Area Manager, Midlands Electricity Board, 126, London Road, Gloucester.

Wolverhampton and District Sub-Area

THIRD ASSISTANT DISTRICT ENGINEER (Lichfield District).

Applicants should have had experience in all branches of distribution work including construction, operation and maintenance of medium and high voltage underground cables, overhead lines and substations, and the maintenance and testing of switchgear up to 11 kV. Technical qualifications desirable. Salary £740/£785 per annum. (N.J.B. Grade E.9).

Apply by letter, within fourteen days, stating age, qualifications, experience, present position and salary, to Mr. D. Holt, Sub-Area Manager, Midlands Electricity Board, 83, Darlington St., Wolverhampton.

A. STEPHENS,
Secretary.
6656

BRITISH KLOCKNER SWITCHGEAR LIMITED

Chertsey, Surrey

TECHNICAL SALES ENGINEERS required for London and Home Counties. Knowledge of motor control gear; sales experience preferred but not essential. Apply giving full particulars to—Managing Director. 166

APPLICATIONS are invited for pensionable posts as

EXAMINERS
in the
PATENT OFFICE

to undertake the official scientific, technical and legal work in connection with patent applications.

Age at least 21 and under 35 years on 1st January, 1957 with extension for regular Forces' service.

Candidates must have (or obtain in 1957) 1st or 2nd Class Honours in Physics, Organic or Inorganic Chemistry, Mechanical or Electrical Engineering or in Mathematics, or an equivalent qualification, or have achieved a professional qualification e.g. A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E., A.R.I.C. For a limited number of vacancies candidates with 1st or 2nd Class Honours degrees in other subjects—scientific or otherwise—will be considered. Exceptional candidates otherwise qualified by high professional attainments will be considered.

Starting pay for 5-day week of 42 hours in London between £605 and £1,120 (men) according to post-graduate (or equivalent) experience and National Service. Maximum of scale £1,345. Women's pay above £605 slightly lower but is being raised to reach equality with men's in 1961. Good prospects of promotion to senior examiner rising to £2,000 (under review) and reasonable expectation of further promotion to principal examiner.

Application form and further particulars from Civil Service Commission, Scientific Branch, 30, Old Burlington Street, London, W.1, quoting S128/57 and stating date of birth.

Interview boards will sit at intervals, as required. Early application is advised. 6653

ENGINEERING INSPECTORS

Transmission Division

THE Transmission Division of A. T. & E. Co. at Liverpool offers positions as ENGINEERING INSPECTORS to men with factory or field experience of line transmission equipment.

Positions are on permanent staff, with generous (contributory) pension fund. The company has full range of welfare activities, including medical and dental facilities.

Applicants should have a good basic knowledge of such equipment or kindred apparatus, and should write to—

The Personnel Manager,
Automatic Telephone & Electric Co. Ltd.,
Strowger Works,
Edge Lane,
Liverpool, 7,

giving full details of experience, qualifications, age, etc.

Assistance with housing and removal expenses can be given in approved cases.

6521

FAWCETT PRESTON & CO. LTD.

Bromborough, Cheshire

require the services of the following staff in their Electrical Division, to be engaged on the design and production of Grid Type Resistors.

DESIGNER-ESTIMATOR
to prepare preliminary designs and estimates.

DRAUGHTSMEN
for detailed designs and layouts.

TECHNICAL CLERK
for production loading and progress work.

Previous experience in resistor work will be an advantage, but is not essential. Superannuation scheme in operation. Please apply to the Personnel Officer. 6597

SOUTHERN ELECTRICITY BOARD

Assistant Engineer (Maintenance)

OXFORD District of No. 2 (Newbury) Sub-Area. Salary N.J.B. Class H, Grade 10 (£835-£880 per annum). N.J.B. conditions of service.

The duties of the post will be to assist with the operation and maintenance of H.V. and L.V. distribution mains and substations, and with minor construction work. A technical training to H.N.C. standard and experience of similar work are required.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Road, Newbury, Berks, and returned to him in envelopes suitably endorsed, not later than 22nd July, 1957.

Showroom Supervisor

Salisbury District of No. 4 (Bournemouth) Sub-Area. Salary N.J.C. Grade 3 (£660 × £20 to £720 per annum). N.J.C. conditions of service.

Applicants must be capable of supervising staff and should have had experience in all showroom duties. They should have a sound knowledge of domestic and commercial apparatus, window displays, sales procedure, the application of tariffs and consumer service.

Applications on forms obtainable from the Sub-Area Secretary, 7, Priory Road, Bournemouth, Hants, and returned to him in envelopes suitably endorsed, not later than 22nd July, 1957.

The successful candidates for the above appointments will be required to contribute to the C.E.A. and Area Boards (Staff) Superannuation Scheme, if eligible. 6647

AIR MINISTRY

ASSISTANT MECHANICAL AND ELECTRICAL ENGINEERS required in Works Department for design, operation and maintenance of mechanical and electrical services on R.A.F. stations at home and overseas and Civil Aviation stations.

Salary according to age; £765 at 25 up to £1,030 at 34 or over, thereafter rising to maximum £1,190 London appointment; somewhat lower in Provinces. Promotion prospects. Appointments non-pensionable but with pensionable prospects. 5-day week with 4-6 weeks' leave a year according to length of service. Special allowance up to £1,450 a year, according to location, payable in addition to salary during overseas service.

Candidates normally must be natural-born British subjects of natural-born British parents and age 25 or over. Minimum qualifications and experience: (i) (a) University degree or equivalent diploma in electrical and/or mechanical engineering with at least 2 years' apprenticeship; or (b) Graduate or Corporate Member of I.E.E. with at least 3 years' apprenticeship; or (c) Graduate or Corporate Member of I.Mech.E., appreciable electrical engineering experience, with at least 3 years' apprenticeship, and (ii) have been employed for minimum of three years with well-established engineering concern and gained wide experience in both electrical and mechanical engineering practice.

Forms, quoting reference D.306/6A, from M.L.N.S., Technical and Scientific Register (K), 26, King Street, London, S.W.1. 259

ARTHUR GUINNESS SON & CO. (DUBLIN) LTD.

St. James's Gate Brewery, Dublin

have a vacancy for an

ELECTRICAL DRAUGHTSMAN.

An excellent opportunity for an enterprising man between 23 and 28 years of age, possessing Higher National Certificate or Part 2 of I.E.E. Examination or equivalent, with experience in lighting, power and electronic layouts in process industry.

The post is a progressive one with a commencing salary in the range £596 to £800 commensurate with qualifications and experience. Promotion to higher grades possible.

Non-contributory pension scheme.

Assistance in moving home.

Please write to the Chief Engineer, giving chronological particulars of education, technical training, apprenticeship and posts held.

For those selected for interview, all travelling expenses will be paid. Successful candidate must pass a medical examination of high standard. 6665

EAST MIDLANDS ELECTRICITY BOARD

Leicester Sub-Area

(a) Senior Demonstrator
(b) Demonstrator

APPLICATIONS are invited from suitably qualified persons for the above positions.

Possession of a recognised diploma in domestic science, or its equivalent, and the E.A.W. Certificate for Demonstrators is essential.

Candidates for appointment (a) must be experienced in general service centre duties, conducting of live demonstrations of all types of domestic appliances both in the Board's service centre and at consumers' premises, also be capable of giving lectures in domestic science to women's organisations and local authorities. Knowledge of industrial and commercial catering would be an advantage.

Candidates for appointment (b) must be experienced in general service centre duties, and be capable of conducting live demonstrations of all types of domestic appliances, both in the Board's service centre and on consumers' premises.

The salaries and conditions of service will be in accordance with Grade 2 (£600 - £660 per annum) and Grade 1 (£490-£590 per annum) respectively of the National Joint Council Agreement.

Applications, stating age, education, qualifications and experience, should be forwarded to the Manager, Leicester Sub-Area, Charles Street, Leicester, so as to reach him within fourteen days of the issue of this advertisement. 6646

CENTRAL ELECTRICITY AUTHORITY

South Wales Division

Vacancy No. 114/57

APPLICATIONS are invited for the superannuable N.J.B. appointment of FOURTH ASSISTANT ENGINEER in the SYSTEM PLANNING SECTION, TECHNICAL DEPARTMENT.

Salary AX/DX 6/5, £710-£1,010 according to experience and qualifications.

The section is concerned with the investigation of schemes for the extension of the 132-kV and 275-kV system in South Wales and has to deal with a wide variety of power system problems, including load flow studies, fault investigations and the analysis of system behaviour. The section has at its disposal a D.C. calculating board and an A.C. network analyser is under construction.

Candidates should have a University Degree or Higher National Certificate, and some practical experience in the supply or manufacturing industries would be an advantage.

Application forms obtainable from Secretary, South Wales Division, Central Electricity Authority, Twyn-y-fedwen Rd., Gabalfa, Cardiff, to be returned by 26th July, 1957. 6610

ELECTRICAL STAFF, WEST AFRICA

APPLICATIONS are invited for appointments as ELECTRICIANS/FOREMAN-ELECTRICIANS with a British-owned company operating in West Africa. Applicants must have had considerable practical experience of electrical contracting work.

Commencing salary will be not less than £80 per month and will reflect the value of the experience and qualifications offered. Free air passages for successful applicants, free quarters and medical attention; generous car allowance; tours of about 15 months and generous U.K. leave.

Written applications giving full details of education, qualifications and practical experience, accompanied by two testimonials, should be addressed to Box R.M. c/o J. W. Vickers & Co. Ltd., 7/8, Great Winchester Street, London, E.C.2. 6599

ELECTRICAL DESIGN ENGINEER

required to take charge of section in Engineering Department responsible for design of Underground Mining Type Switchgear. Applicants should be technically qualified to at least H.N.C. standard and preferably have practical and/or design experience of flameproof equipment.

The position is one of responsibility and wide interest offering scope for advancement.

Applications should be addressed to the Technical Director, B.J-D. Ltd., Stennard Works, Wakefield. 6495

CENTRAL ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following position at SOUTH DENES (Great Yarmouth) GENERATING STATION.

The station, which is at present under construction will have an ultimate capacity of 240 MW. Steam conditions will be 900 lb. sq. in. 900° F. with boilers oil fuel fired.

ASSISTANT ENGINEER
(Efficiency and Testing)

Salary N.J.B. Class H, Grade 7, £995 × £20 to £1,055 per annum.

Applicants should possess the Higher National Certificate in Mechanical and/or Electrical Engineering, and have had previous experience in the efficient operation and testing of modern boilers and turbo-alternators.

Applications, stating age, qualifications, experience and present position, should be sent to the Controller, Central Electricity Authority, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts., by 27th July, 1957.

W. N. C. CLINCH,
Controller.
6662

ELECTRICAL POWER SYSTEMS

Vacancies for

SCIENCE GRADUATES

in Engineering or Physics exist in the Nelson Engineering Laboratories of the English Electric Company Limited, Stafford, for work concerned with theoretical investigations and analytical studies of Electric Power Systems.

Prospects for advancement are good.

Analytically minded candidates who in spite of the attraction of new fields realise that the field of Electric Power Engineering still presents a rewarding challenge, should write with full details to—

Dept. C.P.S.,
336/7, Strand, London, W.C.2,
quoting Ref. ER.1218Q.

6580

AIR MINISTRY

STATION ENGINEERS (Boilerhouse) required for shift work at Sealand, Near Chester, Greenham Common, Berks and London Airport. Quals. required (a) apprenticeship of not less than 3 years as fitter; (b) technical education to O.N.C. (Mechanical) or equiv. standard; (c) experience in the operation and maintenance of boilerhouse plant (experience of high pressure water boilers or water tube steam raising boilers and chain grate stokers an advantage). Duties supervisory.

Commencing salary according to age, quals. and exp. on range £620-£780 per annum, Greenham Common and Sealand or £640-£805 London Airport, plus shift allowance of 6s. 6d. a shift. Lodging allowance payable in certain circumstances. Appointments non-pensionable. Normally only natural born British subjects.

Write giving age, full details of quals. and exp. to P.E.89, City of London Employment Exchange, Professional and Executive Register, 1-6, Tavistock Square, London, W.C.1. No original testimonials should be sent. Only candidates selected for interview will be advised. 256

DRAUGHTSMEN

DRAUGHTSMEN required for large electrical manufacturing company in South Africa. Experience of design, layout and detailing of electrical switchgear is desirable, but general experience on mechanisms and details is acceptable.

Some initial training may be necessary in this country before proceeding abroad.

All positions offer scope for advancement.

Apply stating age, qualifications, experience to—Box 6615.

AMENDED ADVERTISEMENT

SOUTH OF SCOTLAND ELECTRICITY BOARD

Ayrshire Area

Second Assistant District Engineer, Mauchline District

APPLICATIONS are invited for the above superannuable appointment from candidates who are Graduates of the I.E.E., or who hold equivalent qualifications and have had a sound engineering training with experience on distribution systems up to and including 33 kV.

The salary will be within Class E, Grade 7 of the N.J.B. agreement, £835/£880 p.a.

A house in Cumnock can be made available to the successful applicant.

Applications on the standard form, obtainable from any Area Manager, should be received not later than 23rd July, 1957.

A. E. ROOTS,
Manager.
Greenholm Street,
Kilmarnock.
6th July, 1957. 6675

CENTRAL ELECTRICITY AUTHORITY

Headquarters

STATISTICAL ENGINEER required in the System Planning Branch at Headquarters, London, S.E.1. The successful candidate will be required to take charge of the application of statistics to long-term planning problems in electricity supply and to advise on statistical and economic aspects of forward planning. The kind of problems envisaged includes the application of the theory of probability to interconnected systems, forward load estimation and the study of load trends.

Candidates should have knowledge of mathematical statistics and should preferably hold either a university degree in statistics or in mathematics, or in economics with statistics as a special subject. Postgraduate experience is also desirable.

Salary £1,210-£1,570 p.a.

Application forms obtainable from D. Moffat, Director of Establishments, Winsley Street, London, W.1, should be completed and returned by 31st July. Quote ref. E.R./307. 6628

POWER STATION SUPERINTENDENT

required for modern industrial station with pass-out turbo-alternators providing steam and energy for a large continuous process plant, present capacity 7,500 kW, and process steam 100,000 lb. per hour, shortly to be increased.

Candidates should be Corporate Members of the Institution of Mechanical and/or Electrical Engineers, or possess equivalent qualifications, and have had previous experience in a similar capacity, including maintenance of station. Operational experience with high-pressure (1,000 lb. s.i.) boilers and turbines in stations of similar or larger capacity an advantage.

Very good salary with permanent and progressive position for first-class man who has the right experience and qualifications. Age 35-50. Pension scheme; possible assistance with housing.

Applications, which will be treated in confidence, should state age, qualifications, experience and present remuneration, and be addressed to Personnel Manager, Box C.562, Lee & Nightingale, Liverpool. 6583

COLVILLES LTD.

invite applications for the position of

SHIFT CHARGE ENGINEER

for the power station of their new Ravenscraig Works at Motherwell. The station will have an initial capacity of 30 MW of electrical plant and 25,000 h.p. of other turbine plant.

The power station is also the control centre for all power services (electricity, gas, water and steam) within a large integrated iron and steel works—and this position offers a wide field of interest.

All applicants should have suitable qualifications and experience in boiler, turbine and switchgear operation.

Possession of a Higher National Certificate will be an advantage.

The position is superannuable.

Applications should be made to the Works Manager, Colvilles Ltd., Ravenscraig Works, Motherwell. 6582

***Situations Vacant** (continued)*

CITY OF NOTTINGHAM EDUCATION COMMITTEE

People's College of Further Education
Principal: W. W. Dixon, M.Sc., A.R.I.C.

APPLICATIONS are invited for appointment as INSTRUCTOR principally for City and Guilds Electrical Installation Course 51 B subjects.

Salary will be in accordance with the Burnham Technical Scale for Assistants Grade A (£475 × £25 to £900), or Assistants Grade B (£650 × £50 to £1,025). The salary scale and commencing salary will be according to qualifications and experience.

Further particulars and form of application may be obtained from the undersigned, to whom completed forms should be returned not later than 27th July, 1957.

W. G. JACKSON,
Director of Education.
Exchange Buildings, Nottingham. 6655

CENTRAL ELECTRICITY AUTHORITY

Headquarters

ASSISTANT ENGINEER required in the Leeds Regional Office of the Production, Inspection and Test Sub-Branch. Candidates should preferably be A.M.I.Mech.E. or possess equivalent qualification and have had recent experience of production, inspection and testing of power station plant and equipment in manufacturer's works. Experience in the steel industry would be an advantage.

Salary £1,160-£1,510 p.a. according to qualifications and experience.

Applications, stating age, qualifications, experience, present position and salary, to D. Moffat, Director of Establishments, Winsley Street, London, W.1, by 27th July, quoting ref. E.R./308. 6625

CENTRAL ELECTRICITY AUTHORITY

South Wales Division

Vacancy No. 116/57

APPLICATIONS invited for superannuable N.J.B. appointment of ASSISTANT ENGINEER (Combustion), UPPER BOAT POWER STATION, near PONTYPRIDD.

Salary H.9, £885 × £15 to £930 per annum.

Applicants should possess H.N.C. or equivalent qualifications. Previous experience of the economical operation of turbines, pulverised fuel and stoker-fired boilers desirable. Experience of boiler instrumentation an advantage.

Application forms obtainable from Secretary, South Wales Division, Central Electricity Authority, Twyn-y-fedwen Rd., Gabalfa, Cardiff, to be returned by 26th July, 1957. 6642

REQUIRED FOR CONSULTANTS' OFFICE

ELECTRICAL ENGINEER, able to design, prepare specifications and reports, analyse tenders, prepare drawings and handle correspondence with clients and contractors for all types of electrical generation, distribution and utilisation schemes for ports and factories. Applicants should have had a broad and varied experience. Salary £900-£1,250 per annum according to experience.

ELECTRICAL DRAUGHTSMEN, able to design electrical power and lighting and distribution schemes for ports and factories. Salary £750-£900 per annum according to experience. Superannuation scheme.

Apply Personnel Dept., Sir Bruce White, Wolfe Barry & Partners, 1, Lygon Place, Grosvenor Gardens, London, S.W.1 (Tel. Sloane 0431). 6630

SHEFFIELD REGIONAL HOSPITAL BOARD

ASSISTANT ELECTRICAL ENGINEER, experienced in designing, lighting and power schemes. Contracting experience desirable. Permanent superannuated post, 21 days' annual holiday, alternate Saturdays.

Salary £700-£1,015, plus car allowance.

Career details, including qualifications, to the Secretary, Sheffield Regional Hospital Board, Old Fulwood Road, Sheffield, 10, by the 26th July, 1957. 6598

BLACKPOOL EDUCATION AUTHORITY

Technical College and School of Art

Engineering and Science Department

REQUIRED for September, 1957:—
ASSISTANT GRADE "A" to teach Electrical Installation Theory and Practice to City and Guilds Certificate "B" level. Ability to take Electrical Engineering Science to National Certificate S.2 level a recommendation. Salary Burnham Award, 1956, with allowance for industrial experience.

Application forms and further particulars obtainable from the Chief Education Officer, 3, Caunce Street, Blackpool, should be returned as soon as possible.

ERNEST C. LEE,
Town Clerk. 6612

ASSISTANT SITE ENGINEER (ELECTRICAL)

required by the largest modern integrated steel plant in Europe.

Applicants should preferably have experience in electrical installation for power and boiler plants, including mechanical handling equipment.

Higher National Certificate in Engineering would be an advantage.

If you are interested in this position, please write quoting the reference ED/191/ER and give details of age, experience, qualifications and present salary to:—

Superintendent, Personnel Services,
THE STEEL COMPANY OF WALES LTD.
(Steel Division),
Abbey Works, Port Talbot, Glam.

6634

DESIGNER-DRAUGHTSMAN

required by

W. H. ALLEN SONS & CO. LTD.
BEDFORD,

for work in the development and design of A.C. and D.C. motor control gear.

This position offers interesting work and good prospects to the selected candidate.

Generous pension scheme. Assistance towards removal expenses.

Apply in writing, giving full details of experience, to the Personnel Manager.

6663

BRITISH KLOCKNER SWITCHGEAR LIMITED

Chertsey, Surrey

ESTIMATOR for TECHNICAL SALES. Correspondence and capable of preparing control schemes involving automatic motor control gear. Experience essential.

CIRCUIT DIAGRAM DRAUGHTSMAN. Preferably experienced in preparing automatic control gear schemes.

Applicants to have O.N.C. (Electrical). Excellent opportunities with fast growing concern. Pension scheme. Apply to Managing Director, stating experience and present salary. 165

STONE CHANCE LTD.

have a vacancy at their Crawley factory, in Sussex for a SALES and CONTRACTS ENGINEER.

Experience in electrical engineering is essential. Assistance with housing in the area will be given and applicants should send full details of age, experience and qualifications to the Personnel Manager, Gatwick Road, Crawley, Sussex.

6654

CENTRAL ELECTRICITY AUTHORITY

Midlands Division

GENERAL ASSISTANT CHEMISTS are required at Walsall, Hams Hall and Meaford Power Stations. N.J.B. service conditions, superannuable appointments, salaries in accordance with Schedule A of the Agreement, within the range £635 to £730 per annum, dependent upon the station to which appointed.

Applicants should possess the Ordinary National Certificate in Chemistry, or be pursuing a course of study for a higher qualification, and should have had practical laboratory experience, preferably connected with the analysis of water, fuels and oil.

Apply, quoting vacancy number 589MD on form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 23rd July, 1957. 6658

NORTH EASTERN ELECTRICITY BOARD

Tees Sub-Area

APPLICATIONS are invited for the appointment of SECOND ASSISTANT DISTRICT ENGINEER, Darlington District.

Applicants must be qualified electrical engineers with sound practical training and experience in the construction, operation and maintenance of overhead and underground networks and associated plant and equipment.

Salary Schedule A, Class F, Grade 7, £885/£930. N.J.B. conditions of service.

Applications stating age, qualifications and experience to be received by the Secretary (Establishments), G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. 6650

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

SECTION ENGINEER required at Llangefni in the Anglesey District. Salary within range £835/£880 p.a. (N.J.B. E/7).

Applicants should have experience in the construction and operation of E.H.T., H.T. and L.T. overhead and underground distribution systems, including indoor and outdoor substation equipment. Technical qualifications desirable.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhostyllen, Near Wrexham. Closing date, 25th July, 1957. 6645

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

THIRD ASSISTANT ENGINEER (Planning and Development) required at No. 3 Sub-Area Headquarters at Chester. Salary £935/£995 per annum (N.J.B. K/10).

Applicants should have had experience in all aspects of the distribution of electricity, knowledge of the technical and economic principles underlying the design of distribution networks, and possess suitable technical qualifications.

Appointment subject to medical examination. Pension scheme.

Applications on forms obtainable from the Manager, No. 3 Sub-Area, Electricity House, Newgate Street, Chester, must be forwarded not later than the 25th July, 1957. 6643

NORTH WESTERN ELECTRICITY BOARD

THIRD ASSISTANT ENGINEER (Planning and Design), SUB-AREA ENGINEER'S DEPARTMENT, OLDHAM.

Applicants should have had experience in the planning of H.V. and L.V. systems, estimating, system calculations and general technical investigations. Preference given to applicants who hold the H.N.C. (or equivalent) in Electrical Engineering.

Salary scale £935 × £20 to £995 p.a., Grade K.10. N.J.B. conditions.

Applications, naming three referees, to Sub-Area Manager, No. 3 Sub-Area, North Western Electricity Board, Union Street, Oldham, by 20th July, 1957. 6613

CLASSIFIED ADVERTISEMENTS ARE PREPAID

CENTRAL ELECTRICITY AUTHORITY

South Wales Division

Vacancy No. 115/57

APPLICATIONS are invited for the superannuable N.J.B. appointment of ASSISTANT MAINTENANCE ENGINEER (Mechanical) at USKMOUTH POWER STATION, near Newport, Mon.

Salary K.9, £995 × £20 to £1,055 per annum.

Appropriate engineering qualifications and experience of high-speed pumping plant and turbine maintenance an advantage.

Application forms obtainable from Secretary, South Wales Division, Central Electricity Authority, Twyn-y-fedwen Rd., Gabalfa, Cardiff, to be returned by 26th July, 1957. 6641

A LARGE CABLE COMPANY

engaged in the manufacture of mains cables requires an

ASSISTANT PRODUCTION MANAGER.

The position is one of responsibility and carries possibilities of rapid promotion.

Applicants should be in the 25/35 year age group and preferably have had similar experience in industry, although this is not essential.

The position carries a salary of £950-£1,500 per annum, according to experience.

The company has a pension scheme.

Write Box 6666, giving full details of experience, etc., which will be treated in confidence.

Applicants may specify on THEIR ENVELOPE the name of any company to whom they do not wish their application to be forwarded.

SOUTH WALES ELECTRICITY BOARD

ASSISTANT ENGINEER (Construction) required at Pontardulais in the West Central Sub-Area of the Board.

Applicants should have experience of overhead and underground mains construction work.

Salary Class L, Grade 13 (£835/£880) of the N.J.B. Schedule.

Applications stating age, present position and salary, qualifications, experience and three referees should be addressed to the Secretary (Establishments Section) to arrive not later than 29th July, 1957.

R. G. WILLIAMS,
Secretary.

St. Mellons,
Cardiff. 6648

CENTRAL ELECTRICITY AUTHORITY

Headquarters

SENIOR LANDS OFFICER required in London for administrative duties connected with the wayleaving of overhead lines and related negotiations with national and local authorities and the public. Experience in this work is necessary and a knowledge of the relevant legislation an advantage.

Salary within scale £1,525-£1,675 p.a.

Applications, stating age, qualifications, experience, present position and salary, to D. Moffat, Director of Establishments, Winsley Street, London, W.1, by 19th July, 1957. Quote ref. E.R.305. 6626

CENTRAL ELECTRICITY AUTHORITY

South Western Division

ASSISTANT SHIFT CHARGE ENGINEER required at PLYMOUTH "B" POWER STATION.

Superannuation scheme. Salary N.J.B. Class G, Grade 9, £835-£880 (plus 10% shift allowance); ultimate classification of station, J.

Applicants should have had sound technical training and practical experience in a modern power station.

Applications on form A.E.6/ACT obtainable from Divisional Secretary, 26, Oakfield Road, Bristol, 8, should be completed and returned by 27th July, 1957. 6661

CENTRAL ELECTRICITY AUTHORITY

Headquarters

SENIOR ASSISTANT SURVEYOR required in London to deal with agricultural and estate agency problems arising in wayleaving and erecting overhead lines. Candidates should be members of the R.I.C.S. (Lands Agency) or Land Agents' Society and have good experience of estate management, agriculture and forestry.

Salary within scale £1,375-£1,525 p.a.

Applications, stating age, qualifications, experience, present position and salary, to D. Moffat, Director of Establishments, Winsley Street, London, W.1, by 19th July, 1957. Quote ref. ER/306. 6627

CENTRAL ELECTRICITY AUTHORITY

South Wales Division
(Vacancy No. 117/57)

APPLICATIONS invited for superannuable N.J.B. appointment of OPERATION AND EFFICIENCY ENGINEER, USKMOUTH POWER STATION.

Salary K.5, £1,325 to £1,415 per annum.

Applicants should possess H.N.C. or other equivalent qualifications. Experience of the safe and efficient operation of large modern turbines and pulverised fuel boilers desirable.

Application forms obtainable from Secretary, South Wales Division, Central Electricity Authority, Twyn-y-fedwen Road, Gabalfa, Cardiff, to be returned by 26th July, 1957. 6657

A GRADUATE mechanical engineer is required to lecture in thermodynamics and/or machine design and to assist in laboratory instruction. Appointment to be on sessional basis for the first year, after which a permanent appointment as assistant professor may be made. Appointee will be permitted to undertake a certain amount of consulting work. Duties to commence 1st September, 1957. Apply to Dean of Engineering, University of Alberta, Edmonton, Alberta, Canada, for further terms of the appointment. 6616

A LARGE electrical engineering company wishes to appoint a senior executive to take full control of a unit producing medium and large electric motors and alternators. The appointment carries full responsibility in the production, commercial and design fields, and candidates must have a first-class knowledge of the manufacture of electrical rotating machines. Applications, which will be treated in strictest confidence, should be addressed to—Box 6631.

A MECHANICAL engineer is required to lecture in thermodynamics and/or machine design and assist in laboratory instruction. The appointment to be made initially on sessional basis for the first year, after which a permanent appointment as lecturer may be made. The appointee will be permitted to take up to a certain amount of consulting work. Duties to commence 1st September, 1957. Apply to Dean of Engineering, University of Alberta, Edmonton, Alberta, Canada, for further terms of the appointment. 6617

A MECHANICAL engineer of not less than Higher National Certificate standard, with some electrical knowledge, required in the West Midlands for interesting work in connection with accessories and power sources for automatic and manual arc welding. The post is pensionable and offers good prospects to a keen engineer capable of working on his own initiative. Salary range £700 to £900 according to age, experience and qualifications. Apply giving full particulars to—Box 6619.

A PROGRESSIVE electrical engineering company in the North-East of England invites applications from men, possessing the necessary qualifications, for the position of manager of its research and development department. Applicants, who should be between 30 and 40 years of age, must have had actual experience in research management, preferably in the electrical or metallurgical industries. An honours degree would be an advantage but emphasis is placed on managerial experience. The commencing salary will be not less than £1,500 per annum, and there is an excellent contributory pension scheme. Applications, giving details of education, experience and present position held, should in the first instance be made to—Box 6559.

ARMATURE winders wanted for repair shop. Apply — Minta, Hartley Road, Luton. 9036

ASSISTANT electrical engineer. Applications are invited from men of Grad. I.E.E. standard with a good knowledge of instrumentation, protective systems, electronics and power distribution systems. Preference will be given to applicants with previous paper mill experience. Apply giving details of age, training and experience to—Bowaters United Kingdom Pulp and Paper Mills Limited, Thames Division, Northfleet, Kent. 6584

ASSISTANT engineer required, young man 25/35 preferred, for electrical contracting dept. State experience, salary required, etc. Apply to—Manager, First Garden City Ltd., Estate Office, Letchworth. 6664

ASSISTANT to trade association secretary, for committee work, correspondence and general duties; good general education essential; experience in electrical industry and in committee work advantageous. State full particulars and salary required.—Box 6632.

BRITISH ENGINE BOILER & ELECTRICAL INSURANCE Co. Ltd., 24, Fennel Street, Manchester, 4. Electrical surveyors required for various districts in Great Britain. Permanent positions carrying progressive salary scale £675 to £1,000 and non-contributory pension. Candidates, age 26 to 32, preferably with H.N.C. in Electrical Engineering or Grad. I.E.E., and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply in own handwriting, stating age, qualifications and experience. 6623

CHIEF electrical engineer. Applicant must be fully trained and preferably graduate engineer able to deal with problems of high and low tension factory power distribution connected with works maintenance and the installation of heavy rolling mills and their ancillary equipment. Must also be conversant with fully automatic control gear, substation layouts with grid control rectification. Pension scheme. Age 28-40. Apply giving age, salary expected and full details of qualifications and experience to—The Chief Engineer, The Weldless Steel Tube Co. Ltd., Wednesfield, near Wolverhampton, Staffs. 6621

CIRCUIT draughtsmen required by firm manufacturing industrial control equipment. Commencing salaries up to £800 per annum for first-class men, but some less experienced draughtsmen required. Canteen facilities, pension scheme, holiday commitments recognised. Housing assistance later to approved cases. West Middlesex area. Write, giving age, experience and full details, to—Box 6434.

COMMERCIAL catering equipment. Experienced designer/draughtsman required by leading electrical manufacturers. Permanent progressive position backed by first-class production facilities. Excellent conditions, pension scheme, etc. Apply "Designer/Draughtsman." —Box 6586.

CONTRACTORS, old-established and progressive, invite applications for posts of: (a) Experienced estimating engineer; (b) Designer draughtsman able to design electrical installations of all descriptions; (c) Junior for (a) or (b). The posts offer good prospects and salary, also visits to sites. Write in confidence to Managing Director, Alliance Electrical Co. Ltd., 2, Henrietta Street, London, W.C.2. 190

DESIGNER - draughtsman (electrical) with first-class knowledge and experience in switchgear, overhead line and substation equipment. Good salary and house available in Surrey. Excellent prospects in expanding company. All applications treated in strict confidence.—Power Connectors Ltd., 2, Caxton St., Westminster, London, S.W.1. 9029

DRAUGHTSMAN, junior, required by firm specialising in special-purpose switchgear and substation fittings. Good salary to applicant with initiative.—Power Connectors Ltd., 2, Caxton Street, Westminster, London, S.W.1. 9030

DRAUGHTSMEN required, preferably with experience of medium voltage metalclad industrial switchgear. A.E.S.D. rates of pay and bonus scheme, non-contributory superannuation scheme also in operation. Assistance with housing will also be given if necessary to selected applicants. The company is within 6 miles of the South Devon coast. Write stating experience, age, etc., to Ottermill Switchgear Ltd., Ottery St. Mary, Devon. 6477

DUE to rapid expansion, we are again requiring several first-class electricians for industrial installations. Top rates and conditions. Apply—H. F. Scriven Ltd., 33/37, High Town Road, Luton. 6618

ELECTRICAL contractors Midland area, well-established and growing company, require assistant manager and estimator. State experience and salary required.—Box 6587.

ELECTRICAL draughtsman. National Certificate standard or equivalent in electrical engineering. Experienced in electrical switchgear and distribution diagrams, automatic contactor switchgear for motor control. Previous paper mill experience preferred. Apply in writing giving details of age, training and experience to—Bowaters United Kingdom Pulp and Paper Mills Limited, Thames Division, Northfleet, Kent. 6585

***Situations Vacant** (continued)*

ELECTRICAL contractors require an estimator, previous experience desirable, for industrial and commercial power and lighting work.—The Midland Electric Installation Co. Ltd., Cyprus Works, Upper Villiers Street, Wolverhampton. 6569

ELECTRICAL draughtsmen able to work with minimum supervision required by power station contractors, for work on nuclear power development. 5-day week, superannuation scheme, good prospects and salary commensurate with qualifications and experience. Office situate south of Manchester. Write fully in first instance to—Chief Draughtsman, Box 6425.

ELECTRICAL draughtsmen required for electrical layout work in iron and steel works in the Midlands. Good housing prospects in the area. Superannuation scheme and canteen facilities. State qualifications, experience and salary required.—Box 6562.

ELECTRICAL engineer required as branch manager (Manchester area) of established electrical contractors. Applicants should have sound knowledge of electrical contracting industry. Reply in strict confidence giving full details of experience and salary required to—Box 155.

ELECTRICAL engineer surveyors required by the Cornhill Insurance Company Ltd. in either Warwick, Leicester or Northampton. Applicants must have winding shop experience and technical education to H.N.C. standard. Salary commencing £675 rising to £1,000 per annum. Pension scheme. Reply stating age and experience to Chief Engineer, P.O. Box 10, 57, Ladymead, Guildford, Surrey. 6633

ELECTRICAL instrument test room assistants required with experience in wiring, calibration and testing of electrical measuring instruments. Apply in writing to — Everett, Edgcumbe & Co. Ltd., Colindale Works, Hendon, London, N.W.9. 6600

ELECTRICAL sales engineer required for London and Home Counties. Experienced man preferred, but consideration given to representative with genuine urge to sell motors and control gear. Good salary, pension scheme. Write stating full particulars to—Ref. P.M., Veritys Ltd., Brettenham House, Lancaster Place, Strand, London, W.C.2. 6588

EVERSHED & VIGNOLES Ltd. require junior technical assistant for their servo section sales office. O.N.C. or equivalent. Write giving full particulars to Instruments Manager, Acton Lane Works, Chiswick, London W.4. 6589

EXPANDING hearing aid firm has vacancy for expert technician. Must be conversant with all recent developments. Offers rapid promotion to suitable man.—Audi-Vis (Lancs) Ltd., 133, Broom Lane, Levenshulme, Manchester, 19 (Tel. Rusholme 2676). 6667

EXPERIENCED electrical breakdown man required urgently. Experienced in all types of electrical machinery. Suitable accommodation found for the right man. Apply—Collins Electrical Ltd., 22, St. Albans Place, Upper Street, London, N.1. 6404

EXPERIENCED plastics extruder operator required for the production of special cables. New department and plant. A man with initiative and one looking for advancement essential. Write, stating experience, in the first instance—Box Y.556, c/o Streets, 110, Old Broad Street, London, E.C.2. 6590

INSIDE sales and contracts engineers required by the Electrical Rotating Machines Division of the Brush Electrical Engineering Company Ltd. at Loughborough, Leicestershire. Applicants should have received an engineering training and possess an O.N.C. in Electrical Engineering as a minimum qualification. Previous commercial experience will prove an advantage, as successful applicants will be required to handle correspondence with customers, with home and overseas representatives, and to prepare and submit tenders and/or to handle resultant orders. A good salary will be paid, commensurate with the importance of the job, and attractive working conditions include a generous non-contributory superannuation scheme. Applications, giving particulars of past experience and qualifications, should be addressed to the Chief Personnel Officer. 6635

CLASSIFIED ADVERTISEMENTS ARE PREPAID

INSPECTION engineers, electrical. A North-East Coast engineering firm engaged on work associated with nuclear power stations requires good, forceful engineers who have experience in inspection and testing of electrical equipment. Applicants should preferably have H.N.C. and be in the 25-40 age group. Superannuation scheme in operation.—Box 6566.

JOHNSON & PHILLIPS Ltd. have vacancies for young electrical engineers who have completed their training and National Service. Minimum qualification H.N.C. Good prospects for suitable candidates. Applications, giving particulars of training, qualifications and age, to —Manager, Employment and Welfare Dept., Messrs. Johnson & Phillips Ltd., Victoria Way, Charlton, London, S.E.7. 6405

JOINTER (E.H.T.) required in Aberystwyth District of the Merseyside and North Wales Electricity Board, No. 4 Sub-Area, based on Machynlleth. Rate of pay 4s. 7½d. per hour (44-hour, 5-day week). N.J.I.C. conditions, including pension scheme. Standard application forms obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhostyllen, near Wrexham. 6644

LINE EQUIPMENT Limited have vacancies for draughtsmen, preferably experienced in E.H.V. switchgear. Modern D.O. Pleasant surroundings near coast, pension scheme. Apply to Line Equipment Limited, Bridgend, Glamorgan. 6668

MANAGER required by London electrical contractor for the Leeds area branch. Applicants must be conversant with all types of electrical contracts, P.A. installations, P.A.X. telephone installations. Please reply stating age, salary required, to—Giles (Electrical Engineers) Limited, 37-41, Bedford Row, London, W.C.1. 6564

MANAGER required by London electrical contractor for the Sheffield area branch. Applicants must be conversant with all types of electrical contracts, P.A. installations, P.A.X. telephone installations. Please reply stating age, salary required, to—Giles (Electrical Engineers) Ltd., 37-41, Bedford Row, London, W.C.1. 6565

MANAGER required for radio and electrical department in large overseas store. This vacancy will be of particular interest to men possessing real initiative who are interested in working in a rapidly developing country where their progress will depend solely on their own efforts and abilities. Applicants, who should not be over age 35, must have experience of management in the selling and servicing of well-known makes of radio and electrical equipment. The vacancy is in West Africa and the commencing salary will depend on qualifications and experience, but will not be less than £1,000 per annum. In addition there are family allowances, free furnished quarters, free passages and free medical attention in Africa. There is a contributory pension fund which provides certain guaranteed benefits, including widows' and children's pensions and provision for retirement where the qualifying age for a pension is not reached. Initial kit allowance of £75. Tours of about 21 months each followed by substantial leave on full pay. Apply giving particulars of experience to—Box 6601.

OPPORTUNITY in a medium-sized heavy electrical manufacturing concern. An important vacancy in higher management on the works side. Applicants (30/45) should have a thorough engineering background and be fully conversant with modern manufacturing and production methods. Give qualifications, full details of experience, salary required and age. —Box 6592.

OUTSIDE sales engineers required to undertake the selling of small fusegear units and ancillary equipment. Applicants should preferably have received a sound electrical engineering background, but it is also desirable that they should have had experience of the wholesale electrical trade. This is an excellent opportunity for men with initiative. The successful candidates will operate from certain of our branch offices throughout the country, after an initial training period at our Loughborough works. A good salary will be paid commensurate with the importance of the job, and attractive working conditions include a generous non-contributory superannuation scheme. Applications, giving particulars of past experience and qualifications, should be addressed to the Chief Personnel Officer, Brush Electrical Engineering Co. Ltd., Loughborough, Leics. 6636

PRODUCTION efficiency engineer required by West London electrical engineers. Applicants with extensive experience in methods of production of medium capacity switchgear and heat controlling devices are invited to apply for important position involving operational investigations, production methods applying to machine and press shops, tool designs, time and motion study and general reorganisation of assembly departments on modern lines. Only top-class applicants considered. Write full particulars, technical education, practical experience, salary required and when available to—Box 6532.

PROGRESS engineers. Applications are invited from young, keen and forceful mechanical and/or electrical engineers by a North-East Coast engineering office. Applicants should be between 25 and 40 years of age and should have up to H.N.C. or equivalent. The post involves visiting works throughout the country and is superannuable after a probationary period. Apply stating salary required to—Box 6567.

QUALIFIED engineer or engineering designer/draughtsman required to be trained as asst. chief draughtsman in a neon sign and light engineering factory. When replying please give details of qualifications, experience, age and salary required to Claude-General Neon Lights Ltd., Wembley Hill Estate, Wembley. 6496

REFRIGERATION engineers, fully experienced, for the London and Greater London areas. High salary and commission for right persons. Transport provided. Strict confidence. —Telephone J. C. M., MUSeum 0990. 6570

REQUIRED by well-known manufacturing electrical engineers, Manchester, young man, experienced in sales promotion and advertising/publicity matters. Good prospects for keen, ambitious man. Apply in confidence to—Box 6602.

SWITCH sales representatives, senior and junior, required by Santon Ltd., to work from their London office. Applications by letter which will be regarded as strictly confidential, with full particulars of experience, together with present salary, to—East Acton Arcade, Old Oak Common Lane, London, W.3. 6593

TECHNICAL assistant required with H.N.C. or Degree in Physics or Electrical Engineering, to deal with various aspects of development of power capacitors and the use of a surge-generator of 1½ m. volts. The post also provides a good opportunity for experience in the high-voltage field in connection with the testing of power transformers up to 15,000 kVA. Apply in writing in the first place to — Chief Engineer, Bryce Electric Construction Co. Ltd., Kelvin Works, Hackbridge, Wallington, Surrey. 6669

TECHNICAL writer required with experience in the preparation of technical literature and instruction manuals relating to mechanical and electrical equipment. Experience in the arc welding industry an advantage but not essential. This is an interesting and pensionable post with a salary in the range of £700 to £900 according to age, experience and qualifications. Apply giving full particulars to—Box 6620.

TRANSFORMER designer (senior) required. Applicant must have wide experience in design and manufacture of units up to 250 kVA. Promotion to directorship offered after qualifying period with commensurate salary and bonus. Housing accommodation if required. Replies will be treated in strict confidence.—Stewart Transformers Ltd., 75, Kilburn Lane, London, W.10. 6670

TURBINE Division of the Brush Electrical Engineering Co. Ltd., Loughborough, require experienced tendering and contract engineers. Preference will be given to those having both tendering and contract experience, but consideration will be given to those having one or the other qualification. Technical qualifications to H.N.C. or equivalent are desirable. These vacancies offer first-class opportunities in an expanding organisation, and a good salary will be paid. The factory is situated in a pleasant Midland town, within easy reach of a number of cities. Conditions of service include a generous non-contributory staff assurance scheme. Please apply to the Chief Personnel Officer. 6611

YOUNG engineer, preferably with university degree and sound electrical knowledge, required for training in the design of A.C. and D.C. revolving machines. London district. —Box 6533.

TWO stores assistants required by progressive London wholesaler. Good knowledge of trade desirable. Good prospects ; non-contributory pension scheme. Apply in writing to—The National Electrical Supplies Co. Ltd., 240/244, King Street, Hammersmith, London, W.6. 6671

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

BUYER/manager (37), 16 yrs.' experience. Conversant all aspects electrical wholesaling plus technical knowledge. Immediately available London or Home Counties in similar capacity.—Box 9018.

E.H.T. and L.T. jointer and mate want jointing at piece work rates.—Box 9032.

ELECTRICIAN seeks job, installation, maintenance, electrical, mechanical. All-round wide experience. Work on own initiative. First-class work.—Box 9033.

EXPERIENCED representative, age 42, resident Leicester, with connection in M.E.B. and E.M.E.B. areas requires position commencing 1st September.—Box 9019.

FOREMAN electrician seeks change. Public works, industrial, domestic. Complete supervision.—Box 9020.

TO manufacturers : Wholesaler's branch manager, early 40's, energetic and more ambitious than present scope will allow or reward, seeks change to first-class representation.—Box 9027.

ARTICLES FOR SALE

CRABTREE I.C. SWITCH AND FUSEGEAR

WE have purchased the remaining stocks of this make and can offer immediate delivery of most types from 10 to 100 amps., D.P., T.P. and S.P. & N.; also

CRABTREE WOOD-CASED DISTRIBUTION BOARDS

and spare fuse bridges for most of the range.

Very Attractive Discounts.

Apply for complete lists of types available :

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4, Carburton Street, London, W.1
(Tel. MUSeum 3966) 6603

TOWER LADDER FOR SALE

PEDESTRIAN-operated electrically propelled Tower Ladder, elevated by hand. Platform equipped with safety rails and rotates through 360°. Elevated height 22′ 6″. Chassis fitted with levelling jacks, and full lighting equipment. Complete with 24-volt battery and Legg charger.

Further particulars may be had from M. Glover, Esq., Lighting Superintendent, Burnside Street, Kilmarnock.

W. L. WALKER,
Council Chambers, Town Clerk.
Kilmarnock.
4th July, 1957. 6672

750-kVA ALTERNATOR FOR SALE

600-kW BELLISS-LAURENCE SCOTT Steam Set, 120 lb. steam pressure, 2-10 lb. back pressure, coupled to 750-kVA Alternator, 400/3/50, 300 r.p.m., with switchboard. Built 1936. Excellent condition.

REED BROTHERS (ENGINEERING) LTD.
Replant Works, Woolwich Industrial Estate, London, S.E.18
(Tel. Woolwich 7611/6) 6640

ELECTRIC HOUSE SERVICE METERS

PREPAYMENT and credit, 200/250 v. A.C., s/p., 50 c., 2½-100 A. Fixed or variable tariff. Reconditioned, fully tested and guaranteed 2 years. Prompt delivery, carriage paid.

ALBERICE METER COMPANY
Fairfax Works, Fairfax Rd., London, N.8
(Tel. MOUntview 7944, 6373) 191

FURNACE TRANSFORMERS FOR PROMPT DELIVERY

VARIABLE Voltage Transformers by B.E.T. wound for an input of 400/1/50, secondary voltage output variable between 10 and 20 on load ; units with single and dual outputs with instruments for currents of 700; 600; 500; 450; 400; 350; 300 and 250 amps .

Incorporating 10 position voltage selectors.

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Wood Lane, London, W.12
(Tel. Shepherds Bush 2070) and
Stanningley, Nr. Leeds
(Tel. Pudsey 2241) 6591

A BABCOCK & Wilcox water tube boiler will cut down your fuel costs; we can supply from stock. Two 40,000 lb. evap., 220 lb. w.p.; one 25,000 lb. evap., 200 lb. w.p.; 3,000 lb. evap., 400 lb. w.p.; Spencer Bonecourt boiler; also Marine, Cornish vertical, etc.—Burford, Taylor & Co., Ltd., Boiler Specialists, Burtayco House, Church Street, Middlesbrough (Tel. Middlesbrough 2622). 122

A NUMBER of secondhand electric motors offered for sale including 15-h.p. E.C.C., 30-h.p. B.T.H. with contactor starter, 2 28-h.p. E.C.C. (one with pony starter) and Brookhirst switchgear starters, 1 27½-h.p. Crompton Parkinson slipring motor with Allen West starter and ½-h.p. A.C. motor. All 3-phase, 400/440. Available for inspection. Offers invited for single motors or offer for the whole to clear. Apply—J. Alsford Ltd., Twickenham Road, Hanworth, Feltham, Middx. 164

A.C. and D.C. house service meters, all sizes, quarterly and prepayment, reconditioned, guaranteed one yr. Repairs and recalibrations. —The Victa Electrical Co., 47, Battersea High Street, S.W.11 (Tel. Battersea 0780). 138

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

A.C. and D.C. 1/- Slotmeters. Guaranteed 2 years, 2½-50 amps. From 50/- Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 4487). 169

ALTERNATORS from ½ to 675kVA in stock, single and three-phase, all voltages and frequencies. Guaranteed. Many unused. Send your requirements.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 162

ALTERNATORS, generators, 1-100 kVA, all voltages. Specialists—Powerco Ltd., York Rd., London, S.W.18 (VAN. 5234). 147

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 20/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 24

BARGAINS in electric motors are always being obtained from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Stocks include A.C. and D.C. motors, secondhand and new up to 30 h.p. Starters, slide rails and pulleys. Ring. Mon. 3355 for your requirements. 50

BILLIARD Meters. 1/-, 6d. or 1d. slot. All time settings. From 140/-. See Quarterly.—Tradex, Surbiton. 170

BRUCE Peebles 150-kVA alternator, 600 r.p.m., 400 volts, 3-phase, 50 cycles, 4-wire, complete with control panel.—Whitefield Machinery & Plant Limited, Cobden Street, Salford, 6 (Tel. PEN. 4746). 304

CABLE for sale : .1 sq. in. 4-core P.I.L.C. S.W.A. & S., C.M.A., brand new, 660-volt grade, 2 500-yard drums and 1 214-yard drum, £1 per yard. .04 sq. in. 2-core P.I.L.C.S.W.A. & S., C.M.A., 4s. 6d. per yd.—C. M. Hartshorne & Co. Ltd., 778, New Hey Road, Huddersfield (Tel. Stainland 2103). 9025

CABLE, underground, all types ex stock.—E. M. Tatton Co. Ltd., Kew Bridge, Brentford (Ealing 3155/6). 117

CABLE, underground, PILC/VIR/LC, ex London stock. Cutting orders same day delivery London area. Send for priced stock lists.—Batt Electrical Co., 6, Dock Street, London, E.1 (Tel. ROYal 5905). 316

CIRCUIT breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

CONVERTERS, 110 and 220 v. D.C./230 v. A.C., .5 to 6 kVA; also A.C./D.C. Special voltages at short notice.—Powerco Ltd., York Rd., London, S.W.18 (VAN. 5234). 150

CRANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 22

DIESEL generating sets, all sizes to 500 kW. Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 16

ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

ELECTRIC motors, generators, control gear, transformers, A.C. and D.C., new and reconditioned; all covered with our usual 12 months' guarantee; large stocks available.—Electropower Co. Ltd., Kingsbury Works, Kingsbury Road, London, N.W.9 (Colindale 4621-2). 42

ELECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—R. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

ELECTRICIANS. Send for details Shaftesbury lightweight "Bantam" ladders. Top sections fitted with patent moulded rubber blocks, eliminate possibility of scratching or marking walls, fascias, and other painted or highly polished surfaces. Also available for immediate delivery, steps, platform steps, trestles, telescopic trestles, pole and builders-type ladders, and all sizes of two and three-section extension ladders.—Shaftesbury Ladders Ltd. (E.R.), 453, Katherine Road, London, E.7 (Phone: Grangewood 3363/4). 111

FLUORESCENT fittings, lamps, starters and control gear for home and export. Fully guaranteed by actual manufacturers. Send for catalogues.—The Anglo-American Electrical Company, Olive Street, Bury, Lancs. 245

FLUORESCENT tubes reconditioned and guaranteed as new for 7s. 6d. each. Free collection and delivery in Lancs and Yorks.—The Anglo-American Electrical Company, Bury New Road, Breightmet, Bolton, Lancs. (Telephone, Bolton 7251). 212

FOR sale, H.T. transformer-rectifier set, input 380/420 v., single-phase, output up to 40,000 v. at 375 milliamps. D.C. Unused, by Ferranti. List price less 75%. Further details from—Box 6572.

FOR sale: 1 300-kVA, 11-kV/400-v. indoor transformer by B.E.T., in service up to last month; can be seen and inspected S.E. England. —Box 6637.

GENERATING plants, remote and M/F up to 10 kVA; also secondhand A.C. and D.C. sets up to 100 kVA, large stock all types. Special plants built at short notice.—Powerco Ltd., York Rd., London, S.W.18 (Tel. VAN. 5234). 151

GENERATING sets for sale, petrol, diesel and steam, from 1 kW up to 700 kW. A.C. and D.C. switchboards.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 161

GERMAN manufacturer of f.h.p. motors, 1st class quality, seeks outlets. Large or small quantities. — C. O. Schimmer, 93, Aldersgate Street, London, E.C.1. 9031

HOUSE service meters, C. & H., Aron. E.A.C., 20-240 v. A.C., s.-ph., 50 c., 2½ amps., 7s. 6d. each, 1s. 6d. postage; 5 amps., 17s. 6d.—Universal Electrical, 217-221, City Road, London, E.C.1. 37

MERCURY arc rectifier sets, 2, twin bulb type by E.C.C., input 400 volts, 3-phase, 50 cycles, output 110-115 volts D.C., 450 amps., 49.5 kW. Automatic regulator and D.C. control panel, complete with 2 E.C.C. transformers : 81 kVA, 3-6-phase, 50 cycles, oil-cooled, input 400 volts, 101 amps., output 119 volts P-N, 130 amps. Can be seen working.—Box 6673.

MOTOR generator sets and converters, all sizes and voltages from ½ kW up to 500 kW in stock.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, City Road, London, N.1 (Tel. Clerkenwell 5512, 5513 & 5514). 12

MOTORS, starters, circuit breakers. Large stock of all types, ½ to 300 h.p., new or reconditioned, for immediate delivery. Stock list or quot'n by return.—J. S. Ramsbottom & Co. Ltd., Elec. Engs., Keighley (3774/5/6). 70

NAMEPLATES, engraving, diesinking, stencils.—Stilwell & Sons Ltd., 153, Far Gosford Street, Coventry. 108

Articles for Sale (continued)

PHASE converters, single to three-phase, several sizes in stock up to 90 h.p., 3-phase loading.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 29

PLATING dynamos and motor generator sets, various sizes from 500 amps. up to 2,000 amps., with A.C. or D.C. motors.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 15

POLYPHASE kilowatt hour meters. Available from stock.—Universal Electrical, 221, City Road, London, E.C.1. 40

PREPAYMENT 1s. slot house service meters. —Universal Electrical, 217-221, City Road, London, E.C.1. 36

PURLEY chokes and ballasts. Our 80-w. tapped h.p.f. ballast with starter switch-holder incorporated is proving itself the most popular unit. Suitable for most fittings. 57s. 6d. each subject.—F. W. Blanshard Ltd. (Dept. ER), Purley, Surrey (Uplands 4818/9). 52

QUARTERLY Credit Meters, single & poly-phase, 2½-100 amps. From 17/6d. Also D.C. See Television.—Tradex, Surbiton. 171

ROTARY converters in stock, all sizes: enquiries invited.—Universal Electrical, 221, City Road, London, E.C.1. 34

SMALL BA screws and nuts in steel, brass and stainless steel, from stock.—Premier Screws & Repetition Co. Ltd., Woodgate, Leicester. 180

TELEVISION slotmeters & Time Switches. Details from: Tradex Meter Co., Surbiton. Elmbridge 4487. 172

TENDERS are invited for the purchase of a 1,000-kilowatt turbo-alternator, by G.E.C., 1929, for pure back pressure generation. Complete with all equipment, including exciter, David Brown gears, air and oil coolers, etc. Initial pressure 350 lb./sq. in. at 650° F. Exhaust pressure 60 lb./sq. in. at 400° F. Output 40,000 lb. per hour. This machine has been regularly maintained and is in good working order. Can be inspected under full load. For complete information apply—Boots Pure Drug Co. Ltd., Head Offices, 37, Station Street, Nottingham. (Attention Mr. R. Sykes, Engineer's Department, Beeston.) 6604

VENNER time switches, 200-240 v. A.C./D.C., 10-50 amps., from stock.—Universal Electrical Co., 221, City Rd., London, E.C.1. 38

WARD Leonard motor generator sets, all sizes.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1 (Tel. Clerkenwell 5512). 10

400-cycle to 1,500-cycle motor alternators and alternators.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 27

1,000 new storage cells for sale, heavy duty, 570 amps., ebonite container and sealed covers. Orig. made for Admiralty, packed 4 per wood case for transit. Low price for quantities.—Burleigh Alpine Works, Empire Way, Wembley (Tel. 0211). 324

EQUIPMENT FOR HIRE

GENERATING set hire service. Consult the most experienced firm for A.C. and D.C. units from 2 kW to 240 kW diesel or petrol. stationary or mobile, sale or hire. 24-hr. breakdown service.—Dawson-Keith Ltd., Hillview Rd., Sutton, Surrey (Fairlands 4401). 46

RELIABLE, self-contained diesel electric generating sets for hire, 2.5 to 260 kW. Night and day maintenance service. Quotations by return.—Whitetrade Limited, Rochester, Kent (Tel. Chatham 4638/9). 294

ARTICLES WANTED

HARRINGTON & SONS, reclamation contractors, want redundant A.C./D.C. electric motors and transformers, stocks of cable, etc. — 109, Beaconsfield Street, New Beckton, East Ham, London, E.6 (ALB. 1388). 315

MERCURY (Quicksilver) wanted. Write for packing instructions. Gold, silver and platinum also purchased.—Collingridge & Co. Ltd., Riverside Works, Riverside Rd., Watford (Tel. 5963). 114

MERCURY scrap (quicksilver) wanted. Top prices paid by Sterling Products Limited, Leyborne Avenue, Ealing, London, W.13 (EALing 9248/9). 6622

READY money for redundant electrical equipment. Complete works bought outright for expert and rapid dismantling.—F. C. Larkinson Ltd. (Est. 1880), Hitchin Street, Biggleswade, Beds. (Tel. 2391) (12 branches throughout the country). 281

SURPLUS laminations, enamel copper wire, screws, nuts, flex. Good prices paid. Full details to—Box 199.

SURPLUS stocks of all types for domestic electric appliances wanted for prompt cash. Large funds available.—Spears, 14, Watling St., Shudehill, Manchester (Phone, Blackfriars 1916) (Bankers, Midland Bank Ltd.). 8818

VACUUM specialist firm in Scotland wishes to buy large quantity of upright vacuums for cash. Write giving all particulars to—Box 6638.

WANTED, D.C. and A.C. ball-bearing motors, motor generator sets, dynamos and alternators. Full details to—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1. 13

WANTED for prompt cash, ferrous and non-ferrous scrap, also plant for dismantling. Buyers of secondhand machinery and plant for re-use.—W. & H. Cooper Ltd., 176, Brady St., Bethnal Green, London, E.1. 120

WANTED, rotary converters, any sizes.—Universal, 221 City Rd., London E.C.1. 35

WANTED, surplus stock cable, all types and sizes. We can inspect.—Box 220.

WORK WANTED AND OFFERED

A.C. and D.C. motor rewinds and repairs. Prompt service, fully guaranteed.—Edgware 5566/9; Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. 92

ARMATURE winding. Capacity available for winding of small high-speed armatures. Also electrical/mechanical assemblies. Enquiries —E.R. Appliance Manufacturing Co. Ltd., 680 (rear), High Road, Leytonstone, London, E.11 (LEY. 1921). 6605

PRODUCTION sheet metal capacity available by company with stove enamelling and electrical assembly facilities, i.e., fluorescent fittings, electric fires, etc.—Box 6576.

SMALL armature, stator, transformer and general coil winding undertaken on production run.—Kensal Electrics Ltd., 151, Kensal Rd., London, W.10 (LAD. 4530). 202

AGENCIES

AGENTS required by manufacturers of fluorescent fittings and control gear calling on wholesalers and contractors in the Bristol and West Country, South Wales and Newcastle areas.—Box 6575.

AGENTS required calling on retailers and large stores. Good commission. Complete range domestic appliances, replacement elements. State territory and other lines carried.—Box 6573

AGENTS required complete range terminal blocks—porcelain, bakelite, nylon, etc. Applicants must have connections with manufacturers. State territory and other lines carried. —Box 6574.

OLD-establ. comp. supplying components to electrical and radio mfrs. only, requires for resale additional items, f.i. repetition parts, terminals, etc., etc. Pt. payment. Highest refs. Propositions, please.—Box 6674.

BUSINESS OPPORTUNITIES

ACTIVE directorship wanted in well-established electrical manufacturing business by one with excellent connection area boards, leading contractors, etc. Investment if necessary £10,000 to £15,000.—Box 9035.

ELECTRICAL contractors, North East Coast, established nearly 40 years, expanding into the field of plant and speciality equipment distribution, would like to make contact with manufacturers interested in establishing sole distribution, installation and maintenance arrangements in the four Northern Counties and the North Riding of Yorkshire.—Box 6454.

MANAGING director of old-established firm of electrical contractors in the N.W. on account of age and declining health is desirous of meeting suitably qualified engineer willing to assist in running the establishment with a view to ultimately taking over the business—or would sell shares outright now. All replies treated in strict confidence.—Box 6534.

MANUFACTURERS of quality fluorescent fittings, tubes, starters and control gear wish to contact quantity buyers, wholesalers, agents, etc., interested in purchasing in quantity at special low prices. Advertisers are interested in long or short term arrangements.—Box 213.

BUSINESS PREMISES

FACTORY, warehouse, garage, East London, 10,000 sq. ft., 8,000 covered, 2 entrances, single-storey, concrete floor. To let on lease 14-21 years.—Box 9037.

SHOP premises in the new town of Corby available, on 21 years' lease, together with maisonnette (if required). For further details apply to the Clerk of the Urban District Council, Council Offices, Corby, Northants. 6639

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CONSULTING ENGINEER, ELECTRICAL AND HEATING,

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ELECTRICAL contractor's business. Very old estab. Pleasant Surrey suburb. Freehold shop and house. Mostly outside work with small shop trade. Scope for great expansion in younger hands. Price incl. freehold £5,000 S.A.V. or offer. Mortgage arranged. Sole agents: Kennards Estate Office, North End, Croydon (4455). 6594

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CITY & Guilds (Electrical, etc.) on "No Pass —No Fee" terms. Over 95% successes. For full details of modern courses in all branches of Electrical Technology send for our 144-page handbook. Free and post free.—B.I.E.T. (Dept. 12A). 29, Wright's Lane, London, W.8. 100

LEARN electrical engineering the practical way. Our new self-study course includes equipment on which experimental work can be carried out. Also courses for all professional examinations. Free brochure from E.M.I. Institutes, Dept. ER57, London, W.4 (Associated with H.M.V.). 318

COMPANY MEETINGS

TELEPHONE MANUFACTURING COMPANY

THE 27th Annual General Meeting of the Telephone Manufacturing Company Limited was held on 8th July in London, Mr. Fred. T. Jackson, O.B.E., Comp.I.E.E. (Chairman and Managing Director), presiding.

The following is an extract from his circulated statement: The trading of the company and its subsidiaries for the year 1956 resulted in a profit before providing for taxation of £272,095, which is £59,594 less than the corresponding figure for the previous year, the larger part of this decrease being due to the less favourable results of the Carrington Manufacturing Company Limited. After deducting taxation of £154,961 and adjusting net profits applicable to minority interests in the Carrington Company, the Group net profit amounted to £105,096 as compared with £127,219 for 1955. The net profit of the Parent Company after taxation amounted to £102,418, a reduction of £8,813.

In spite of the shortage of labour your company had a successful year. Turnover increased by 14%, thus offsetting the increase in costs to which I referred last year, and of our total output 19% went to overseas customers. Orders in hand on behalf of the British Post Office were substantial and we had been fortunate in obtaining a number of export orders which although at unremunerative prices helped to absorb our overhead expenses.

Unfortunately it appears that the activities of the British Post Office have been affected directly and indirectly by the restrictions on credit and also by the increases in their tariffs. As a result the waiting list for telephone service is now being overtaken much more rapidly and it seems certain that the value of contracts to be placed in the current year will be on a lower level than in the past few years. I feel that this is only a temporary phase, but in the meantime it must have its effect on our Order Book, and consequently our results for the current year are unlikely to be as favourable as they have recently been.

The report was adopted and the total distribution of 10% was approved. 6579

limit switch

For all heavy duty limit switch applications, particularly those to withstand conditions of extreme severity, there is a suitable B S A — ACME SNAP-LOCK of either water, oil and dust proof or flameproof versions. The superiority of this switch is due largely to the simplicity but ruggedness of its mechanical and electrical units contained in seperate compartments within a robust housing. Unique Snap-Lock design ensures self-wiping quick make and break, positive contact, maximum resistance to wear, and accurate repetitive tripping.

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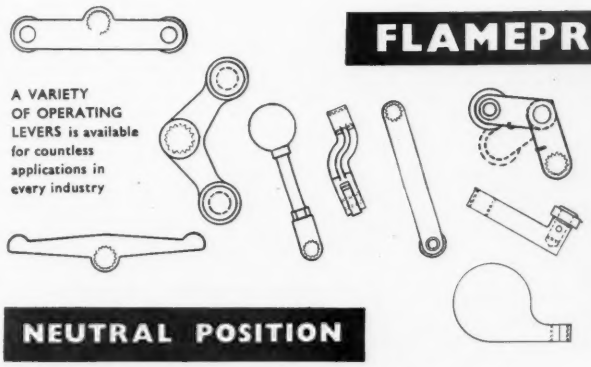
STANDARD

FLAMEPROOF



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NEUTRAL POSITION

These limit switches are now available in Neutral Position versions. Spring-loaded devices return the operating lever to the central (neutral) position. One or both of the springs are removable for various circuit arrangements. A third spring is supplied for converting to one normally made and one normally broken circuit.

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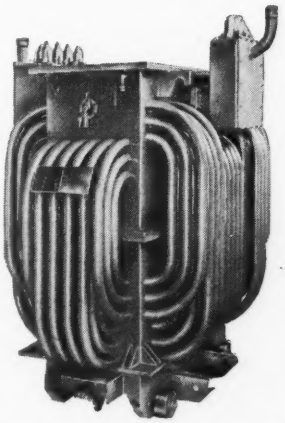

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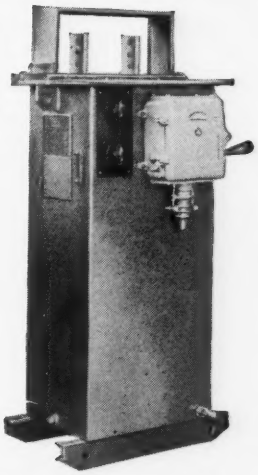

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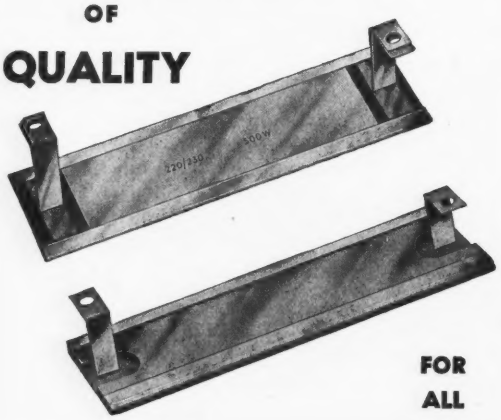

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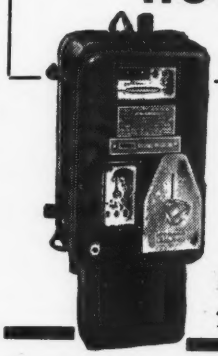

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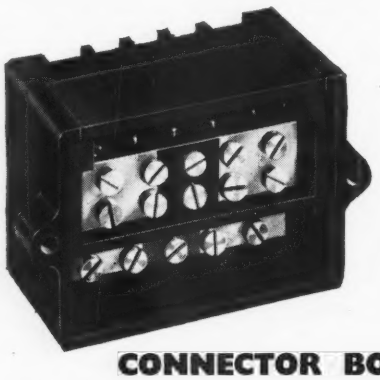

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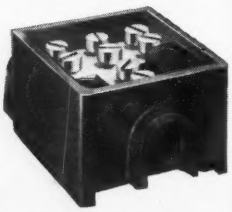

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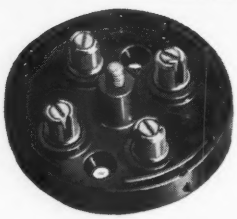

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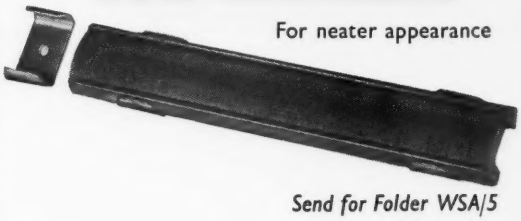

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